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POLICY RESEARCH WORKING PAPER 1311

The Supply Response to Exchange Rate Reform in Sub-Saharan Africa

(Empirical Evidence)

Mustapha Rouis
Weshah Razzak
Carlos Mollinedo

Expansionary monetary policy leads to appreciation of the real exchange rate for 22 Sub-Saharan African countries. Devaluations can be an effective policy tool to correct an overvalued currency, if accompanied by restrictive monetary and fiscal policies.

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Summary findings

In the diversity of exchange-rate regimes in Sub-Saharan Africa in the 1980s, there was a trend toward more flexible regimes and smaller parallel markets. How particular exchange rate arrangements affect such factors as output supply cannot be determined for Sub-Saharan African countries on the basis of experience in other developing countries, because Sub-Saharan countries differ in the composition of their exports and imports, in level of industrialization, and in development of the financial sector.

Rouis, Razzak, and Mollinedo supplement a survey of the literature with empirical testing, using pooled time-series and cross-section data for 22 countries in Sub-Saharan Africa for 1971–91. Among their findings:

- When macroeconomic policies are inconsistent and there is a failure to adjust to adverse shocks, fixed regimes lead to overvaluation and the development of widespread parallel markets for foreign exchange.
- Sub-Saharan African countries have attempted exchange-rate unification through occasional devaluations, a crawling peg, official dual markets, foreign exchange auctions, and a market pricing rule. Most such experiences have been gradual, and their outcomes mixed. Success in exchange-rate unification (as experience in Ghana and Uganda shows) depends on three crucial elements: supportive monetary and fiscal policy, external budgetary and balance-of-payments support, and official commitment to a credible reform process.
- In the face of significant adverse real shocks (internal and external), built-in monetary and fiscal rules in fixed exchange rate regimes with currency convertibility (as in the CFA zone) may be inadequate to bring about the required short-term adjustment.
- As elsewhere in the developing world, the effect of real devaluation on output in Sub-Saharan Africa is mixed in the short-run (contractionary when demand elasticities are low) and neutral in the long-run. Real depreciations have neutral effects on per capita growth of real output in the transition to steady state.
- Farm producers in Sub-Saharan Africa respond to price incentives for a single agricultural crop as farmers do elsewhere in the developing world: they behave rationally. And econometric evidence confirms that growth in agricultural exports is not achieved at the expense of food production.
- Applying the Granger-causality test to this data set reveals strong causality, running in both directions, between money growth rates and inflation. It also shows causality running from output to inflation, and from inflation to nominal devaluations.

This paper — a product of the Africa Regional Office, Office of the Chief Economist — is part of a larger effort in the department region to better understand the supply response to exchange rate reform in Sub-Saharan Africa. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Jocelyn Schwartz, room J5-255, extension 32250 (85 pages). June 1994.

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Table of Contents

Text Tables

Annex Tables

Figure

Summary Findings

Empirical research into key exchange rate issues in Sub-Saharan Africa (SSA) is limited when compared with that in developing countries as a whole. Further, SSA countries possess significant differences from other developing countries in such structural features as the composition of imports and exports, the level of industrialization and the development of the financial sector. Consequently, the pros and cons of particular exchange rate arrangements for such issues as output supply, are not conclusively established from the experience of other developing areas.

Two issues are targeted in this paper. First, SSA countries are distinguished in terms of the exchange rate regimes they have adopted, and the achievement of objectives of exchange rate policy is contrasted across countries. Second, the output supply response of real devaluations in developing countries as a whole is reviewed; then the analysis focuses on SSA countries, with special attention given to the supply response in agriculture.

The review of the literature is supplemented by empirical testing. We used pooled time-series and cross-section data for 22 countries in Sub-Saharan Africa for the period 1971-1991 to address the following questions: the dynamic relationship between nominal and real devaluations, the impact of real devaluations on per capita income, and the causal relationships and the direction of causality between devaluations, inflation, income and exports.

Exchange Rate Regimes

Our review indicates that there has been a wide diversity of exchange rate regimes in Sub-Saharan Africa during the 1980s, with the trend towards more flexible regimes and a reduction in the size of parallel markets. The lessons drawn from the SSA experience concerning the choice of exchange rate arrangement are the following:

- When macro economic policies are inconsistent and there is failure to adjust to adverse macroeconomic shocks, fixed regimes lead to overvaluation and the development of widespread parallel markets for foreign exchange. Through their negative macro-effects this in turn leads to inflation, instability and decline in output growth.

- The exchange rate unification has been attempted by SSA countries through several means: occasional devaluations, a crawling peg, official dual markets, foreign exchange auctions, and a market pricing rule. Most exchange rate unification experiences have been gradual and their outcomes have been mixed. Country experiences show that the success in exchange rate unification (the case of Ghana and Uganda) depends on three crucial elements: supportive monetary and fiscal policy, external budgetary and balance of payments support, and a credible reform process to which the authorities are committed.

- In the presence of significant adverse real shocks (internal and external), built-in monetary and fiscal rules in fixed exchange rate regimes with currency convertibility (e.g. CFA zone) may not be adequate to bring about the required adjustment in the short-run.

Exchange Rate Reforms and Supply Response

Many SSA countries outside the CFA zone have undertaken substantial real depreciations during the 1980s and the early 1990s. In January 1994, the CFA zone countries changed the CFA franc parity from 50 to 100 per French franc, the first such an adjustment since the establishment of the zone in 1948. The objective was to reestablish the zone's competitiveness which has eroded significantly over the years, particularly since the mid-1980s. With the exception of this recent development which is not covered in this paper, the evidence of the supply impact of real devaluations in SSA countries reviewed here are summarized below.

Aggregate Output Supply

- As in the rest of the developing world, the effect of real devaluation on output in Sub-Saharan Africa is mixed in the short run (contractionary when demand elasticities are low) and neutral in the long run. This finding is supported by our own empirical analysis which is based on a growth model with real depreciations of exchange rates as an additional argument. The model shows that real depreciations have neutral effects on per capita growth of real output in the transition to steady-state.

Agricultural Supply

- In the case of a single agricultural crop, the evidence shows that farm producers in SSA respond to price incentives as any other farmers in the developing world. In other words, African farmers behave rationally.

- The evidence also shows that in Sub-Saharan Africa aggregate agriculture supply elasticities with respect to price incentives, including real exchange rate depreciation, are positive and comparable to that in other parts of the developing world.

- The possibility that agricultural exports may crowd out food production was examined. Econometric evidence confirms that the growth in agricultural exports is not achieved at the expense of food production. Food production is positively correlated with export crop prices and real exchange rates, suggesting complementarity.

Export Supply and Simultaneous Expansion

- A number of empirical studies confirm the response of real exports to changes in the real exchange rates in Sub-Saharan Africa (see for instance Balassa and Dorosh). Balassa in particular found that a 1 percent change in the real exchange rate is associated with 0.8 to 1 percent change in the ratio of exports to output. Our empirical testing of the Granger-causality model shows that there is no significant causal relationship between real exports growth rates and real depreciations. This result should, however, be interpreted with caution as fiscal policies are not controlled for in the model.

- Simultaneous devaluations by several SSA countries is unlikely to reduce their total export earnings with the possible exception of cocoa exports. Thus the "fallacy composition" argument, or the "adding-up" problem, does not seem to apply to African commodity exports, except for cocoa.

Inflationary Consequences

- Our empirical testing shows that there is contemporaneous and long run significant relationship between nominal and real devaluations. We find a 10 percent nominal devaluation to have 7.7 percent real effects in the long run. This confirms that nominal devaluation can indeed be an effective tool to correct an overvalued currency if accompanied by restrictive monetary and fiscal policies.

- Applying the Granger-causality test to our data set, we find strong causality, running in both direction, between money growth rates and inflation. We also find a causality running from output to inflation, and from inflation to nominal devaluations.

1

Introduction

Research on exchange rate policy and its impact in Sub-Saharan Africa (SSA) has been fairly limited until recently. Up until the early 1980s, the majority of SSA countries had fixed exchange rate regimes. Apart from the CFA zone countries, which combine a peg to the French franc with full currency convertibility, most SSA countries had closed trade and capital accounts, and hence provided incentives for the emergence of parallel markets in foreign exchange. Following the adverse terms of trade shocks in the mid-1970s, and the tightening of controls in these countries, parallel markets expanded rapidly, becoming major markets in the macroeconomy. During the 1980s, with the emphasis on unification of official and parallel exchange rates, or at least a significant reduction in the size and importance of parallel markets, a wide diversity of exchange rate arrangements arose. In the context of structural adjustment programs, a broad range of initial conditions, macro-policy measures and exogenous shocks have resulted in a similar diversity of outcomes for unification. Research in the area has consequently been stimulated, and the World Bank has recently launched several large cross-country studies in this direction.1/

This paper examines the diversity of exchange rate arrangements undertaken in SSA during the 1980s, provides stylized facts and considers the relative merits of the different regimes. In particular, the successes and failures of exchange rate unification by adopting a more flexible exchange rate regime are evaluated for countries with closed capital and possibly current accounts, and substantial black markets. Lessons from the CFA zone countries are discussed with reference to recent empirical studies.

The paper also addresses a number of key exchange rate issues for SSA countries. First, the output supply response to real devaluation in developing countries as a whole is reviewed. The paper shows how various structural features, such as the composition of exports and imports, and the level of industrialization, distinguish SSA countries from other developing countries. Then the analysis focuses specifically on SSA countries, with special attention given to the supply response in agriculture. Finally, in addition to the review of the literature on exchange rate policy

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1/ These include "Exchange Rate Regimes in Africa" (Pinto, 1989); "Macroeconomic Aspects of Foreign Exchange Markets in Developing Countries: Multiple Markets and Black Markets" (Kiguel and O'Connell, 1992); "Real Exchange Rate (RER) management in the Communauté Financière Africaine (CFA) franc zone" (*); and "Foreign exchange auction markets and exchange rate unification in Sub-Saharan Africa" (Aron and Elbadawi, 1993).

in SSA, the paper addresses three empirical questions using pooled time-series and cross-section data for 22 SSA economies for the period 1971-91. These are the dynamic relationship between nominal and real devaluations, the impact of real devaluations on per capita real GDP growth, and the causal relationships and the directions of causality between devaluations, inflation, GDP growth and exports.

It should be highlighted here that the real exchange rate is an endogenous variable and that nominal devaluation is just one of the instruments that affect its level. Nominal devaluations do not always result in a change in the real exchange rate. The magnitude of such as change depends on the type of fiscal, monetary and income policies that accompany the devaluation.

The paper is organized as follows. Chapter 2 discusses the evolution of exchange rate arrangements undertaken in SSA, examines the successes and failures of exchange rate unification in adjusting countries without currency convertibility, and discusses the experience of the CFA zone countries in the 1970s and 1980s. Chapter 3 reviews existing literature on the effectiveness of output supply response of a real devaluation. And chapter 4 tests empirically the impact of real exchange rate devaluations on economic growth and exports and analyses the relationship between nominal and real devaluations.

2

Exchange Rate Arrangements

A wide diversity of exchange rate regimes is present today in Sub-Saharan Africa. However, until the mid-1970s exchange rate policy had played a negligible role in balance of payments adjustments in SSA countries, and most SSA countries employed fixed exchange rate regimes. These regimes appeared viable in the context of a relatively favorable external environment. However, with the severe oil and commodities market shocks of the mid-1970s, foreign exchange reserves were drained, bringing the fixed rate regimes under pressure. These pressures were exacerbated by a slow fiscal adjustment in the recessionary circumstances. In most cases the response was to defend the overvalued fixed rates by rationing foreign exchange through imposing or tightening exchange and trade controls. The emergence and subsequent rapid expansion of black markets for foreign exchange had their origin in these controls.

At least until the mid-1980s black markets were widespread in SSA. The extent of illegal or quasi-legal black markets in the SSA region is shown in Table 1. Relative to other developing regions (notably Latin America), the parallel markets in SSA countries have tended to be large and thriving markets, with substantial spreads (premia) between the official and black rates (Kiguel and O'Connell, 1992). The size of the black market premia for a number of SSA countries over the periods 1974-80, 1981-86 and 1990-91 is shown in Table 2.

There is a large literature concerning the determinants of these spreads or premia (e.g. Agenor, 1992; Lizondo, 1990). In standard models, expectations and portfolio considerations are likely to be important determinants in the short-run. The long-run steady state premium depends on macro-fundamentals such as the terms of trade, the budget deficit, capital flows and the trade regime. Thus, the prevalence of black markets in SSA have been attributed to inconsistent policies and failure to adjust to adverse macroeconomic shocks, current account deficits, and extreme overvaluation of exchange rates; and the markets have tended to expand during periods of expansive macro-policies (Kiguel and O'Connell, 1992). Several empirical studies on SSA countries have found support for the theoretical determinants of the premium and have shown its

Table 1: Multiple Foreign Exchange Markets in Sub-Saharan Africa.

COUNTRY	PAYMENTS RESTRICTIONS ON:		NATURE OF DUAL MARKET	FREE RATE	MANAGEMENT OF OFFICIAL RATE		ADDITIONAL EXCHANGE RATE
	Capital Account	Current Account			WHEN MERS	POST MERS	
Angola	yes 75-90	yes 75-90	illegal tolerated 75-90	black 75-90	fixed	not unified	
Burundi	yes 70-90	yes 70-90	illegal 70-90	black 70-90	fixed 70-86	not unified	
					peg 86-90		
Ethiopia	yes 70-90	yes 70-90	illegal tolerated	black 70-90	peg	not unified	no
Ghana	yes 70-90	yes 70-90	illegal tolerated	black 70-88	fixed 70-83	free	yes 73-90
				legal 88-90	peg 83-88	unified 4.88	
Kenya				black 70-90	peg	not unified	yes 79-90
Malawi	yes 70-90	yes 70-90	illegal tolerated	black 70-90	peg	not unified	no
Nigeria	yes 70-90	yes 70-85	illegal tol. 70-87	black 70-87	peg 70-90	free	yes 86-89
		no 86-90	legal 87-90	legal 87-90		unified 8.90	
Rwanda	yes 70-90	yes 76-90			fixed		
S. Leone	yes 70-5.86		illegal 70-12.82	legal 12.82-7.83	fixed	unified 83	yes 70-86
	no 6.86-4.87		leg. 12.82-7.83	legal 1.84-9.84		unified 85	
	yes 5.87-90		leg. 1.84-9.84				
			leg. 6.86-4.87				
Sudan	yes 70-90	yes 70-90	illegal tol. 70-87	black 70-90	fixed	not unified	yes
Tanzania	yes 70-90	yes 70-90	illegal tolerated	black 70-90	peg	not unified	yes 82-85
The Gambia	yes 70-86	yes 70-75	illegal 70-86	black 70-86	fixed 70-86	unified	
	no 87-90	no 77-80	legal 86-90	legal 87-90			
		yes 81-86					
		no 87-90					
Uganda	yes 70-86	yes 70-90	legal 70-82	black 70-90	peg	not unified	yes
	yes 88-90		illegal 83-84				
			legal 85-90				
Zaire	yes 71-90	yes 71-90	illegal tol. 70-83	black 70-83	peg	free	yes 9.78-83
			legal 83-84	legal 83-84		unified 8.89	
			illegal tol. 84-90	black 84-90			
Zambia	yes 70-90	yes 70-90	illegal tol. 70-85	black 70-85	fixed 70-76	not unified	yes 2.80-87
			legal 85-87	legal 85-87	peg 76-87		
			illegal 87-90	black 87-89	fixed 87-90		
Zimbabwe	yes 80-90	yes 80-90	illegal 80-90	black 80-90	fixed	not unified	yes 84-90

MERS : Multiple Exchange Rate Systems.
ADDITIONAL ER : Special exchange rates for certain transactions. In some cases, there was no dual market, even though the official exchange rate was fixed or pegged.

Source: Kiguel and O'Connell (1992); IMF and World Currency Yearbook (various issues).

Table 2: Parallel Market Exchange Rate Premium (percent)

Country	1974-80	1981-86	1990-91
Sub-Saharan adjusters /a			
Extremely high premiums in 1990-91			
Mauritania	62.3	121.5	166.6
Mozambique	468.5	2,110.8	62.6
Sierra Leone	21.0 /b	49.4	104.4
Tanzania	125.7	248.8	74.5
Zambia	117.3	46.3	149.7
High premium			
Rwanda	37.7 /c	43.7	47.5
Medium premium			
Burundi	20.3 /c	24.1	20.9
The Gambia	-5.4 /c	13.8	21.3 /d
Malawi	74.5	53.6	29.4
Nigeria	63.3	232.7	25.1
Uganda	728.3	190.0	24.6
Zimbabwe	102.2	81.3	23.5
Low premium			
Ghana	276.6	1,098.2	3.4
Guinea	130.7	655.2	7.6
Guinea-Bissau	..	59.7	-2.3 /d
Kenya	12.5	15.1	7.3
Madagascar	19.3 /c	42.0	7.1 /d
Mean	**140.9**	**299.2**	**45.5**
Excluding Mozambique	**119.1**	**186.0**	**44.4**
Median	**68.9**	**59.7**	**24.6**
Other adjusting countries			
Argentina	94.5	32.8	42.4 /d
Bolivia	8.3	136.2	1.5 /d
Costa Rica	9.2	204.7	15.9 /d
Indonesia	2.4	4.2	2.6 /d
Mexico	1.7	13.9	6.8 /d
Morocco	5.3	6.0	13.1 /d
Philippines	7.1	12.3	7.1 /d
Thailand	-0.6	-2.2	2.0 /d
Turkey	25.7	9.6	2.4 /d
Venezuela	0.0	110.3	5.2 /d
Mean	**15.3**	**52.8**	**9.9**
Median	**6.2**	**13.1**	**6.0**

..Not available

Note: The parallel market exchange rate premium is calculated as the parallel market exchange rate minus the official exchange rate (in domestic currency at the end of the period), multiplied by 100.

a. Data are only for the countries with flexible exchange rates
b. Data are for 1979-80
c. Data are for 1976-80
d. Data are for 1990

Sources: "Adjustment in Africa: Reforms, Results and the Road Ahead". Policy Research Department, The World Bank, 1993.

strong links to the macroeconomy (Kiguel and Ghei, 1992) covering a large sample of developing countries (six of which are in SSA) during 1970-89; Aron and Elbadawi (1992) for Zambia; Elbadawi (1992) for the Sudan; Kaufmann and O'Connell (1991) for Tanzania; Chhibber and Shafik (1990)).

These strong macro-linkages emphasize the importance of the negative macro-implications associated with multiple exchange markets (well-known to exist for the Latin American case of official multiple markets2/, they have been shown to apply too for the SSA case of unofficial multiple markets (Kiguel and O'Connell, 1992)). These include the diversion of trade and productive activity into unofficial channels, narrowing the tax base; an implicit tax on exports due to real overvaluation; prices influenced by the black market, and subject to considerable fluctuations; a fall in savings with the flight from domestic currency, limiting domestic investment and constraining long-term growth. Further distortions were introduced by the administrative allocation of foreign exchange.

Thus, with substantial parallel markets present in SSA from the mid-1970s, the traditional reform objectives of stabilizing the macro-economy and achieving real depreciation became equivalent to the objectives of integrating the parallel market into the official economy and unifying the exchange rates.3/ Allied with this objective is the removal of distortions in the allocation of foreign exchange. Consequently, as part of broader reform programs, a divergence away from fixed exchange rate regimes (in countries without convertibility) towards more flexible regimes has been evident in SSA during the last two decades. The pattern of changes in exchange rate arrangements for the SSA countries as a whole is illustrated in Table 3.

2/ The typical arrangement involves an official market with the exchange rate determined by the authorities, and a second market where market forces determine the rate. The official market usually channels current account transactions of the public sector, and selected transactions of the private sector; while the second market channels the remaining transactions.

3/ The relevant concept of unification where capital controls are retained to some degree, is not eradication but a substantial reduction of the parallel market, in order to delink it from the major sectors of the economy.

Table 3: The Evolution of Exchange Rate Arrangements in Sub-Saharan African Countries: 1976-89.

Exchange Rate Regime	*1976*	*1980*	*1983*	*1989*	*1991*
Pegged to a Single Currency	77.7	63.4	53.5	51.2	45.7
US Dollar	25.0	19.5	14.0	12.8	10.9
French Franc	36.0	34.2	30.2	35.9	30.4
Other Currencies	16.7	9.7	9.3	2.5	4.3
Pegged to a Composite of Currencies	19.5	31.7	37.2	30.8	23.9
Limited Flexibility	2.8	0.0	2.3	0.0	0.0
More Flexible Arrangements	0.0	4.9	6.9	17.9	30.4
Adjusted According to a Set of Indicators	0.0	0.0	0.0	2.5	6.5
Other Managed Floating	0.0	4.9	6.9	7.7	10.9
Independently Floating	0.0	0.0	0.0	7.7	13.0
Total (percentage)	100.0	100.0	100.0	100.0	100.0
More than One Rate for Imports and/or Exports	11.1	12.2	20.9	12.8	10.9

SOURCE: IMF, Exchange Arrangements and Exchange Restrictions (various issues)

The proportion of countries pegging to a single currency declined from 78 percent in 1976 to 46 percent in 1992; with pegs specifically to the US dollar falling from 25 to 11 percent. However, excluding the countries in the CFA zone, which maintained a currency union arrangement pegging to the French franc throughout the period, the table shows single currency peg regimes declined by two-thirds between 1976 and 1992. To neutralize the negative impact of fluctuations in exchange rates of major currencies, an increasing number of countries chose to peg to a composite basket of currencies (notably the SDR): the proportion rose from 20 to 24 percent between 1976 and 1992. By 1992 some form of flexible exchange rate arrangement was introduced in nearly a third of SSA countries, increasing from a negligible 3 percent in 1976. Also notable in the table is the extent to which official multiple exchange rates were utilized during the early 1980s as a transitional medium to more efficient exchange rate regimes. Overall, however, fixed rather than flexible rate regimes remain dominant in SSA.

The impact of exchange rate reform on the black market premia during three reform periods, shown in Table 2, presents a rather mixed picture: some clear successes (e.g. Ghana); some improvements (e.g. Mozambique, Tanzania) and several policy reversals (e.g. Zambia). In the light of the preceding discussion, the objective of a realistic exchange rate reflecting market conditions should be the primary objective for a high premium economy undertaking exchange rate reform. Initially this objective should have greater priority than a second objective of stabilizing the exchange rate.4/ Stabilization is crucial in some Latin American countries where the feed-through coefficient from official devaluation to inflation in near hyper-inflationary conditions is high (e.g. 0.6 for Bolivia, Dominguez (1991)). In SSA countries with large premia, many prices already reflect the parallel exchange rate so that official devaluation is unlikely to have a significant effect on inflation (Aron and Elbadawi, 1992; Chibber and Shafik, 1990). With the achievement of sufficient real depreciation to create a sustainable unification of multiple rates, a stable exchange rate will assume increasing importance. At this point, exchange rate policy in

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4/ The measurement of exchange rate instability poses some problems. Pritchett (1991) suggests that the third moments about the mean (skewness and kurtosis) are a feasible measure of exchange rate uncertainty (volatility) given that variance is not defined for series that exhibit persistence (the official and black rates usually follow a non-stationary series process - see for instance Aron and Elbadawi, 1993a).

small, open economies is driven by two conflicting objectives.5/ Allowing flexibility in the exchange rate can achieve and maintain international competitiveness6/ in the face of internal and external price shocks, and ensure a viable balance of payments; on the other hand, a stable exchange rate can anchor domestic prices.

What lessons can be learned from the recent experience of SSA countries in formulating exchange rate policies, and in the choice of an exchange rate regime to achieve these policy objectives? In particular, what explains the successes and failures of unification in SSA countries? And for countries without significant black markets (due to unification, or currency convertibility (CFA zone)), what evidence is there for the comparative benefits of fixed versus flexible rates?

Table 4 classifies the individual SSA countries according to the exchange rate arrangements outlined in Table 3. In terms of broad policy regimes, these countries can be placed into the following three groups:

(i) Countries with fixed exchange rates, closed capital accounts, and selective price controls (e.g. countries pegged to a basket of currencies);

(ii) Countries with flexible exchange rates (devaluing periodically, using a crawling peg, employing an auction or floating with an interbank market), a closed capital account, and a closed/open trade account;

(iii) Countries with fixed exchange rates, fully convertible currencies and no price controls (CFA zone).

The successes and failures of the countries from Group (i) in achieving exchange rate unification through more flexible exchange rate regimes (Group (ii)) are examined in the section below, with recourse to various empirical studies, and policy lessons are drawn. Then recent studies on the CFA zone are explored to draw lessons for the usefulness of fixed versus flexible exchange rates for countries with currency convertibility, but subject to SSA structural conditions of susceptibility to terms of trade and other exogenous shocks, and fragmented or poorly developed markets in various sectors (including banking).

5/ Corden (1990) discusses the dual roles of the exchange rate in macroeconomic policy, defining the distinct "real targets" and "nominal anchor" approaches.

6/ The real exchange rate, defined as the relative prices of nontradables with respect to tradables, is a proxy for a country's international competitiveness.

A. Exchange Rate Unification: Lessons From Successes and Failures Using Flexible Rate Regimes in SSA.

The implementation of exchange rate unification has varied across countries and as shown above has resulted in successful cases — Ghana, Uganda and Tanzania - and not so successful cases — Zambia and the Sudan. The different outcomes result from the speed of the unification process, the sequencing of accompanying policy measures, the commitment of the authorities to the reform and the availability of external budgetary and balance of payments support. According to Kiguel and O'Connell (1992), unification in SSA countries must be done as quickly as possible, at least for current account transactions. In many of these countries, because of the scarcity of foreign exchange, unification has the limited objective of allowing the most current account transactions to take place in one officially recognized market, keeping some control on capital movements, and thereby justifying a secondary market for foreign exchange (which may be illegal or quasi-legal - a black market; or legalized - bureaux de changes). Most of the unification experiences in SSA have been gradual. However a few countries have moved directly to currency convertibility in an interbank foreign exchange market (The Gambia).7/

There are a number of means by which a gradual unification has been attempted by SSA countries:

(i) **Occasional devaluations** whilst pegged to a currency basket or single currency.

(ii) **A crawling peg**, where the rate moves in a pre-announced fashion (e.g. Ghana 1983-86; Zambia 1983-85).

7/ Since 1986, the Central Bank and the three commercial banks in the Gambia have traded at weekly "fixing" sessions, establishing a rate of exchange closely linked to the previous week's interbank rate, but used only for statistical purposes and immediately superseded by the interbank rate. Bureaux de change were legalized in 1990, and have joined the weekly session, improving competition. The weekly meeting has given the Central Bank a handle on market developments and also a monitoring presence. The Central Bank is a net purchaser in the interbank market for reserve accumulation purposes. The interbank market seems to have functioned relatively smoothly in The Gambia: however, there have been only modest transactions between the banks, and despite the early removal of capital controls, it functions more as a flow than an asset market.

Table 4: Exchange Rate Arrangements in Individual Sub-Saharan African Countries, 1990

Exchange Rate Pegged to US Dollar

- Angola**
- Djibouti
- Ethiopia**
- Liberia
- Sierra Leone

Exchange Rate Pegged to French Franc

- Benin
- Burkina Faso
- Cameroon
- CAR
- Chad
- Comoros
- Congo
- Cote d'Ivoire
- Equatorial Guinea
- Gabon
- Mali
- Niger
- Senegal
- Togo

Exchange Rate Pegged to South African Rand

- Lesotho
- Swaziland

Exchange Rate Pegged to a Basket of Currencies

SDR

- Burundi
- Rwanda
- Seychelles
- Zambia*

Other

- Botswana
- Cape Verde
- Kenya
- Malawi*
- Mauritius
- Mozambique**
- Sao Tome and Principe*
- Tanzania*
- Uganda*
- Zimbabwe

Managed Floating Exchange Rate

- Guinea*
- Guinea-Bissau*
- Madagascar*
- Mauritania

Independently Floating Exchange Rate

- The Gambia*
- Zaire*

Multiple Exchange Rates

- Ghana
- Nigeria
- Somalia
- Sudan

*Countries with widespread black markets, restrictions on capital accounts and selective price controls.

**Countries with widespread black markets, restrictions on capital accounts and extensive price controls but with a lack of effective implementation.

(In Ethiopia, the controls are effective).

(iii) **Official dual markets,** with one exchange rate determined by the authorities and applying to public sector and selected private sector transactions, and a second rate determined by market forces for the remaining transactions (e.g. Zambia 1990-91).

(iv) **Foreign exchange auctions,** where the rate is determined weekly or fortnightly as the marginal or average rate bid when auctioning a fixed supply of foreign exchange to importers or banks (e.g. Zambia 1985-87; Ghana 1986-92; Nigeria 1986-92; Uganda 1983-85, 1992-93).

(v) **A market pricing rule** for administered allocation of foreign exchange: currently a number of countries allocate foreign exchange by means of a first-in-first-out queue, pricing at the free rate in the legalized bureaux de change market (e.g. Zambia 1992-; Mozambique 1992-). Another example would be following a purchasing power parity rule.

The experience of the first two approaches is that with adverse external shocks, large fiscal deficits and low policy credibility, occasional devaluations or an accelerated crawl have failed to provide sufficient adjustment to sustainably unify multiple markets (Elbadawi, 1990). Nevertheless, significant reductions in black market premia have been achieved with a crawling peg (e.g. Ghana, 1983-6). Tanzania provides another example: in 1986, a reform program was launched, which included significant adjustments in the exchange rate, monetary and fiscal policies, increases in the interest rates and producer prices, and relaxation of price controls. The premium dropped from above 700 percent in early 1986 to about 50 percent in mid-1990 (Kiguel and O'Connell, 1992). Zambia in the period July 1983 to October 1985 adopted a crawling peg system for the official rate, accompanied by restrictive monetary and fiscal policy. This effort was unsuccessful, however, due to large exogenous shocks in terms of trade shocks, and foreign aid, and to "the fundamental endogeneity of the parallel premium with respect to macroeconomic and trade policy" (Aron and Elbadawi, 1992).

Official dual exchange rates have frequently been used as a temporary measure: there is a gradual transfer of transactions from the various exchange markets (including the black market) into one particular market. Ultimately the official rates are unified. Both the Sudan and Zambia used dual markets, but without striking success in either case. Sudan allowed a secondary legal market with a floating exchange rate to operate alongside the official market, shifting import

categories from the official market to the secondary market over time. These efforts were accompanied by successive devaluations in the managed rate, in the context of liberalization programs. However, the lack of supporting fiscal policy resulted in depreciation in the legal secondary market. As the authorities tried to enforce a more appreciated rate, transactions shifted to the black market, and there was a reappearance of a large black market premium. A similar story holds for Zambia. Early in 1990, an official rate was designated for government imports, debt service, purchase by government of copper receipts from the state-owned copper sector, and imports not on a positive list for the secondary official market. A more depreciated market rate was applied to all transactions on the positive list: initially only 10 percent of imports by item were on the list, but at the unification of the official rates in April, 1991, over 90 percent of imports had been transferred to this window. Unfortunately the term "market rate" was a misnomer: the second rate was managed and real depreciation resisted by the authorities. Given the high levels of inflation in the period due to insufficiently supportive fiscal policy, at "unification" a thriving black market persisted with a premium of over 100 percent.

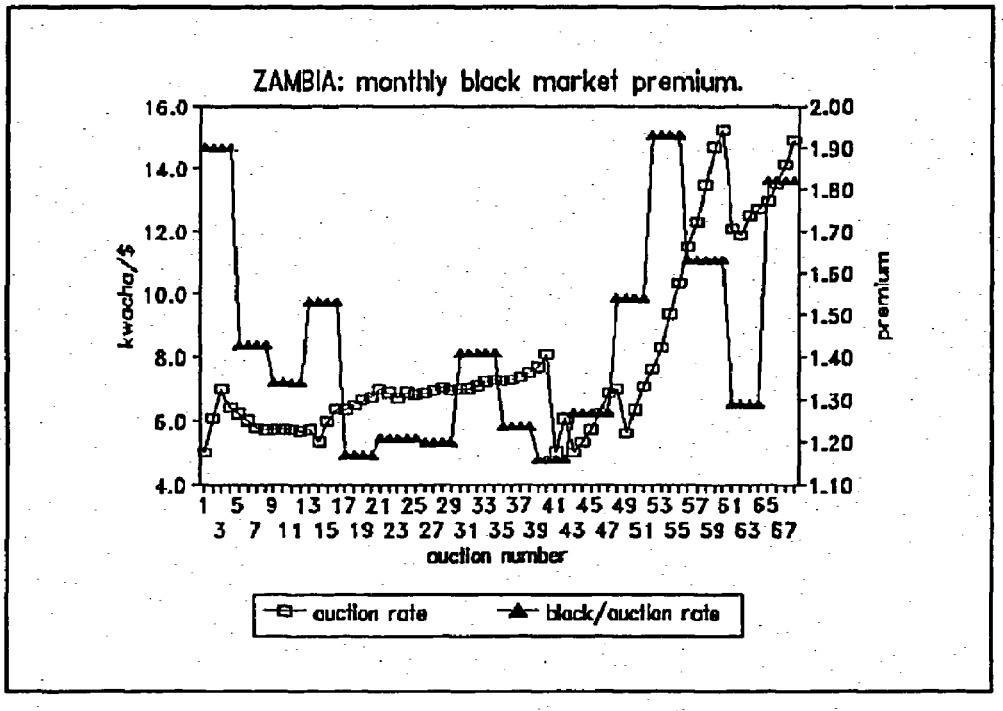
Since the early 1980s, foreign exchange auctions have been fairly widely used outside SSA (e.g. Jamaica, Bolivia, Romania, Russia, Khazakstan), as well as in over nine SSA countries. Auctions operate like a hybrid between a crawling peg system and a floating rate: the pricing and allocation of foreign exchange are fully market-determined, but this rate persists until the next auction. Auctions in SSA have typically been held weekly or fortnightly (e.g. Ghana, 1986-92, Zambia 1985-87, Uganda 1992-93). However, auctions have also been used as an allocation mechanism for government foreign exchange in the context of an interbank market determination of the exchange rate (Nigeria 1989-92). Auctions may have advantages over moving directly to a floating rate in an interbank market where there is insufficient institutional depth to allow effective functioning of a decentralized foreign exchange market, where a few commercial banks have historically been dominant and there is danger of collusion, or where there are limited sources of foreign exchange (Krumm, 1985; Quirck et al, 1987).

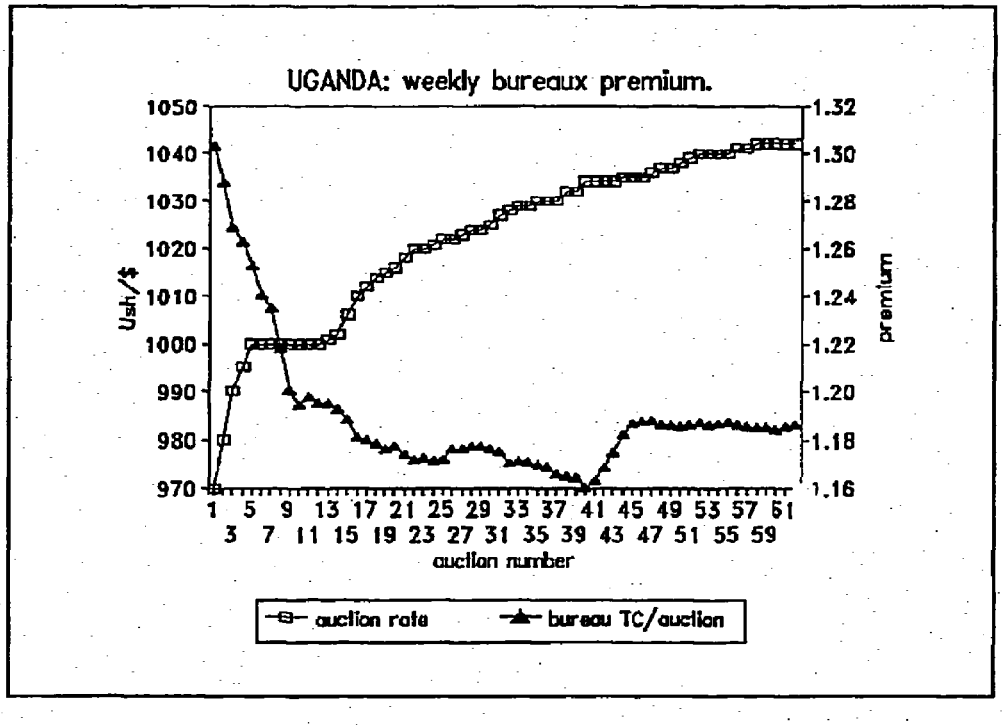
In a typical auction the bidders are importers or commercial banks acting as direct agents of importers (retail auctions e.g. Zambia, Ghana); or commercial banks bidding only for themselves, later allocating freely to importers in a secondary market (wholesale auctions e.g. Nigeria, Ghana). The bids are integrated price and quantity bids. These bids are lined up from

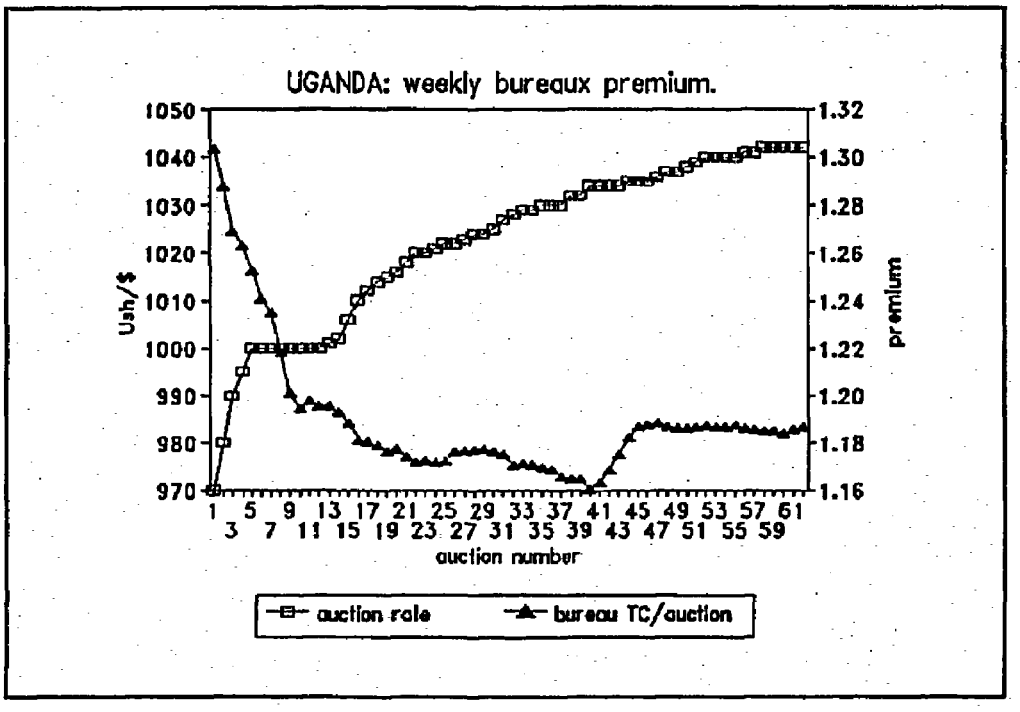
highest to lowest price, and the marginal rate is that rate which fully exhausts the available (perhaps pre-announced) supply. In a **competitive auction** the marginal rate is the exchange rate and is paid by bidders regardless of their bids. In a **Dutch or discriminatory auction**, bidders pay their own price, and the exchange rate may be a quantity-weighted average of the bids, or the marginal price.

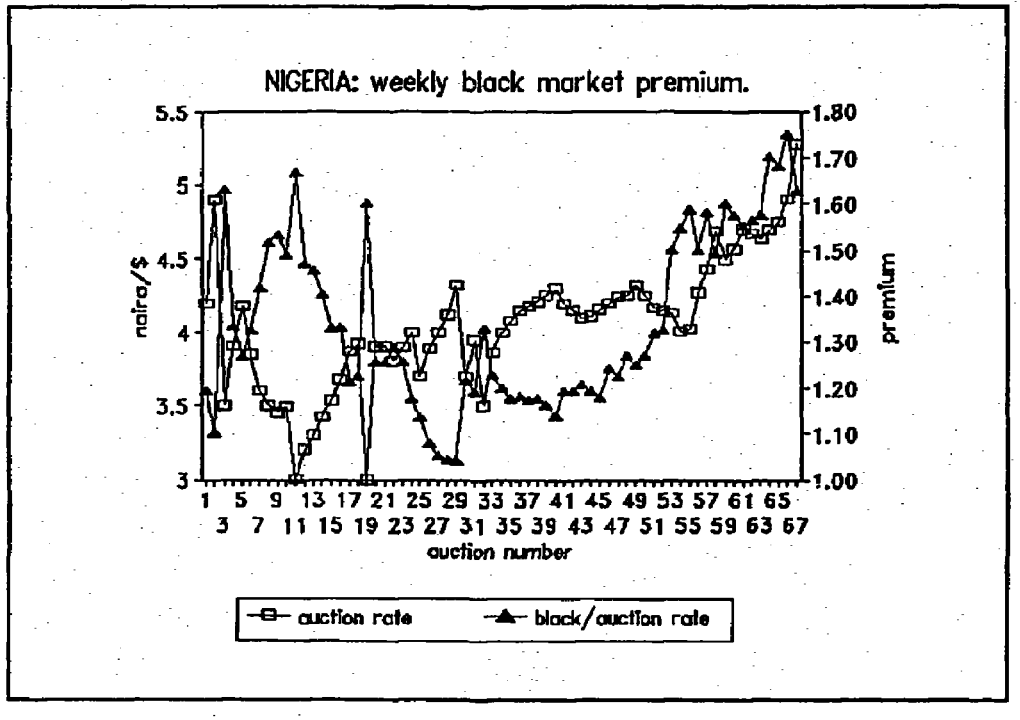
Auctions also offer various control variables to the authorities: the supply offered, a choice of pricing mechanism (competitive or discriminatory), the use of a reserve price (below which the authorities will not accept bids), the possibility of revealing information about the bids, and the right to impose entry restrictions of various kinds. Thus, unless the operation of the auctions is fully transparent, adhering to published rules, the potential exists for government manipulation of the exchange rate. A recent statistical and econometric study using weekly data for foreign exchange auctions in four SSA countries (Ghana 1986-92, Nigeria 1986-88, Zambia 1985-87 and Uganda 1992-3) found a clear distinction between two sets of countries in terms of design features, auction policies and outcomes (Aron and Elbadawi, 1993 a,b). Ghana and Uganda represent a set where auctions have been largely on target in terms of the three policy objectives of exchange rate unification, stabilization of the exchange rate and an efficient allocation of foreign exchange (Figure 1 b,c). On the other hand, the auctions in Zambia and Nigeria were subject to frequent policy interventions, with the consequence of unsustainable auctions, inefficient allocation through ad hoc disqualifications (at least in Zambia), limited unification, and a rather volatile exchange rate (Figure 1 a,d). A distributional analysis found the distribution of the auction rate exhibits left skewness (tendency towards appreciation) in Nigeria and Zambia; while the opposite was observed for Ghana and Uganda.

FIGURE 1 a,b,c,d: **The parallel premium and auction exchange rate relationship (source: Aron and Elbadawi, 1993a).**






UGANDA: weekly bureaux premium.
Ush/$
premium
auction number
auction rate
bureau TC/auction


NIGERIA: weekly black market premium.
naira/$
premium
auction number
auction rate
black/auction rate

The study found that in large measure, the failure to achieve exchange rate unification and a stable exchange rate in Zambia and Nigeria could be attributed to the absence of a reserve price rule. The results suggested that use of a fairly predictable reserve price stabilizes foreign exchange auctions, given the limited depth of SSA financial markets. The rule is learned by bidders, and diminishes speculative bidding. The management of a sustainable and credible reserve price policy requires an efficient secondary market. The use of legalized bureaux markets in Uganda and Ghana had two advantages in this respect: they are likely to be deeper markets, and moreover eliminate the risk-premium associated with illegality. Macro-economic policy remains crucial to the success of the reserve pricing policy (Aron and Elbadawi, 1993a). A stable and consistent macro-economic environment, permitted the development of a stable and steadily depreciating bureaux rate in Ghana and Uganda, while the highly volatile illegal parallel rate was not suitable as a guide for policy in Zambia and Nigeria. Auction rate depreciation as a consequence of increased liberalization and hence competition in the auctions, is consistent with fundamental market behavior, and as such stabilizes the auction and fosters long-term unification. This has been the experience of Ghana and Uganda. In contrast Nigeria and Zambia attempted to stem depreciation through increased entry restrictions (and ad hoc disqualifications) over time: these policies back-fired and merely increased damaging speculative behavior. Given the initial conditions of thin and rather rudimentary financial markets in SSA, an important lesson from Ghana and Uganda is that there may be advantages from a more gradual liberalization for allowing institution-building and learning by agents in the market (bidders, bureaux, commercial banks, and the auction managers (Central Bank)). This may facilitate the transition to a more competitive interbank market, as was the case in Ghana (in contrast to Nigeria). Gradualism may also be justified from a macro-perspective, given the substantial macro-imbalances and the low credibility that often characterize initial conditions in reforming SSA countries.

Estimations of the equilibrium exchange rate established that choosing Dutch over competitive pricing does not provide an automatic revenue advantage, except when there are a small number of bidders engaging in strategic behavior, or where risk-aversion is paramount. However, the Dutch auction may introduce other undesirable features such as enhanced opportunities for collusive practices, a reduced pool of bidders and inefficiencies associated with a multiple rate system. The estimation results found that while supply volatility does not produce

a risk-premium on the level of the auction rate, there is evidence that it is important for auction rate volatility. Thus, the stability of foreign aid could play an important role in compensating for fluctuations in export earnings induced by trade shocks and/or natural disasters. Anecdotal evidence suggests that under the auctions system the efficiency of allocation does improve compared to the previous system of ad-hoc allocation under a fixed rate. However, it is to be expected that ad hoc disqualifications as occurred in Zambia diminished these advantages. Finally, the evidence from Ghana and Uganda as against Nigeria and Zambia, suggests the paramount importance of transparent policy rules and conduct of the auctions. Lack of transparency is tantamount to unnecessary increased discretion by the auction managers, thus exacerbating one of the major potential weaknesses of the auction regime. Most of these results are supported by an earlier study (Mills, 1988). In their policy dialogue and adjustment lending, the IMF and the World Bank have favored the unification of exchange rates (particularly official and black market exchange rates) on the grounds that multiple rates misallocate resources. However, using the experience of Ghana, Nigeria, and Sierra Leone, Pinto (1989) shows that this argument tends to overlook an important consideration which is inflation, "when multiple rates are means of taxation, the widened deficit from unification increases inflation."

Pinto (1989) argues for the primacy of fiscal policy and the need to design the pace of exchange rate policy to be consistent with fiscal reform. The driving idea behind this prescription is that, if the fiscal deficit is not sufficiently reduced, premature policy of an accelerated crawl, for example, when the public sector is a net buyer of foreign exchange, would lead to unsustainable post unification inflation as the authorities find themselves forced to rely exclusively on inflation tax to replace the foregone implicit revenue derived from the taxation of exports through premiums. This begs the question: What has been the trade-off between the benefits of the unification of exchange rates for resource allocation and its costs for inflation in SSA? Evidence is provided by Kaufmann and O'Connell (1990) for the case of Tanzania. To study the fiscal impact of the unification, Kaufmann and O'Connell have calculated the financial position of the government vis-à-vis the private sector to determine whether the government is a net buyer of foreign exchange from the private sector. Preliminary calculations suggest that Tanzania is on the favorable side of this calculation. Given the large inflows of aid being channeled by the government, increases in the official exchange rate provide a fiscal bonus, lowering the fiscal

deficit in domestic currency terms. Devaluation will have a positive effect on revenue collection. This study suggests that official exchange rate adjustments, in the course of unification, are not likely to contribute to inflation by way of fiscal channels.

B. Fixed vs. Flexible Rates Under Currency Convertibility: Lessons From the CFA Zone.

Until the end of the 1970s, CFA countries8/ had better inflation records than other SSA countries9/ and a superior growth rate. Early studies examining the performance of CFA zone countries in the 1970s and first half of the 1980s attributed the long-run growth of output and investment (including foreign investment) to monetary stability, low inflation, the convertibility of the CFA franc and built-in restraints on fiscal and monetary policy (e.g. Guillaumont and Guillaumont, 1984; Devarajan and de Melo, 1987; Guillaumont, et al, 1988b). It has been argued that the fixed exchange rate regime for CFA zone countries has been a contributing factor to their low inflation rates (Guillaumont, et al, 1988b). However, Chhibber (1991) and Honohan (1990) consider that lower inflation in countries with fixed exchange rates has more to do with the underlying financial and monetary arrangements, and the openness of the capital accounts between countries, than the fixed nature of the exchange rate.10/ Moreover, depreciation of the French franc (CFA currency peg) in the 1970s helped to counteract worsening terms of trade in the region, especially after 1973 (Elbadawi, 1991).

The performance of the CFA countries relative to other SSA countries changed dramatically after 1985, with a severe economic decline in the zone. Greater turbulence in terms of trade patterns were experienced11/, as well as an appreciating French franc vis a vis the US

8/ The countries comprising the CFA zone were shown in Table 3.

9/ Median annual inflation in CFA countries was 11.6 percent in the 1970s, declining to 4 percent in the 1980s; whereas inflation in all SSA countries was 14 percent in the 1970s, and about 17.3 percent in the 1980s.

10/ For instance, countries such as Ghana, Uganda and Sierra Leone experienced three digit inflation rates even when the exchange rate was fixed (most prices being influenced by the parallel exchange rate).

11/ Elbadawi and Majd (1992a) (see Table 3, p.15) evaluated the external shocks for SSA countries and for CFA countries. Comparing 1982-85 with 1973-81, external shocks (computed as the sum of terms of trade and real interest effects) and internal shocks (narrowly defined and proxied by the index of food production) were higher in SSA.

dollar. Furthermore, significant real depreciation occurred in key export competitors in SSA. CFA countries were unable to use nominal realignments as a tool to cope with real shocks; instead, they relied on the tight domestic policies through credit controls and fiscal discipline. Whether adherence to a fixed rate regime in the presence of large real shocks disadvantaged the zone is considered in a recent study by Elbadawi and Majd (1992). CFA membership is evaluated in two periods: the 1980s relative to the 1970s, and 1986-89 relative to 1982-85; and economic performance is compared to other SSA countries, and to a broader set of similar developing countries (including SSA).

The first part of the analysis compares long-run and short-run economic performance of these three groups by looking at the evolution of simple averages of key macroeconomic indicators. Contrasting the 1980s with the 1970s, CFA countries appear to have been outperformed by countries in the other two groups; moreover, the competitive position of CFA countries was weaker in the second half of the 1980s than in the first half. These results are consistent with the conclusions of Devarajan and Rodrik (1991) that fixed exchange rates have been, on the whole, a bad bargain for CFA member countries12/ : "... for most of the CFA members, the inflation benefits do not appear to have been large enough to offset the costs on the output side. Under "reasonable" output-inflation tradeoffs, these countries would have been better off having the flexibility to adjust to external shocks."

However, the second portion of Elbadawi and Majd's analysis adjusts for the selectivity bias in the CFA membership decision and uses a modified control group approach (Corbo and Rojas, 1990). This approach leads to more shaded results — controlling for initial conditions, internal and external shocks and policy stance, the CFA members were outperformed in the short-run by other SSA and low-income countries in output growth, export, investment, and savings performance (though not in inflation). This suggests that the CFA monetary rules, while producing inflation stability, were inadequate in bringing about the necessary short-run adjustment. On the other hand, the CFA countries seemed to have done relatively well in the

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Comparing 1986-89 with 1982-85, external shocks where significantly higher in CFA than SSA but internal shocks were lower. Comparing 1982-89 with 1973-81, CFA recorded higher external shocks and SSA higher internal shocks.

12/ These results are based on Devarajan and de Melo's (1990) reassessment - in view of the performance of the CFA countries in the 1980s - of the empirical evidence found in Devarajan and de Melo (1987).

long-run. But, this is not a strong conclusion as sufficient evidence is lacking; the study shows a higher long-run growth rate for CFA countries vs. other SSA countries in only one of its numerous regressions. The study does not resolve the apparent trade-off between growth and inflation in the zone.

3

Exchange Rate Reform and Supply Response

This section is organized as follows. First, the theoretical literature is briefly reviewed. Second, comparative studies on the impact of devaluation on output, and on economic performance in developing countries, including SSA countries, will be discussed. Finally, the supply response of devaluation in SSA countries will be examined in detail, with a particular focus on agriculture.

A. Overview of the Theory

While it is widely accepted that a properly administered devaluation will improve the trade balance and change relative prices, there is little consensus in devaluations' effect on output and employment. Devaluation will either have an expansionary effect on aggregate output, or, in the worst case, will reduce aggregate output.13/ Typically in the literature, the distinction is made between elasticities, absorption, and monetary approaches. The crucial assumption in these models are price flexibility, the degree of capacity utilization, and the emphasis on the demand side of the economy.

The elasticities approach assumes that prices are fixed, and that a nominal devaluation will result in an equiproportional real devaluation. Because the analysis takes place in a partial equilibrium framework,10/ the effects on output and employment are not explicit. If the elasticities approach is embodied in a Keynesian model where output is assumed to be demand

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13/ Some authors consider that, in the long run, the loss of output due to the temporary reallocation of factors of production towards tradable goods is possible.

10/ The elasticities approach assumes that the economy is small and in external equilibrium; this approach states that a devaluation will be effective (improve the balance of payments) as long as the Marshall-Lerner conditions hold.

determined and there exists unutilized production, then the impact of a nominal devaluation on output and employment is positive.

According to the **absorption approach**, the effectiveness of a nominal devaluation will depend on its ability to generate expenditure switching (the composition of expenditures must move from foreign to domestic goods) and expenditure reducing (expenditures must fall with respect to income). If a nominal devaluation induces expenditure switching, then it will affect relative prices and thus, the real exchange rate. If there are unutilized resources, expenditure switching will generate an increase in real output and thus, improvement of the current account. For aggregate output, a devaluation that has a positive effect on the real exchange rate, and that generates expenditure switching, will have a positive effect on the aggregate level of activity.

The **monetary approach** focuses on the interaction between the external sector and the monetary side of the economy. The monetarist model assumes that resources are fully utilized and that the uncovered "interest parity" condition and the "purchasing power parity" condition hold. Consequently, domestic prices cannot fall out of line with respect to foreign prices. A devaluation will be offset by an increase in domestic prices and the real exchange rate will not be affected. Similarly, output will stay at its full employment level. In this setting, however, if domestic credit is kept constant, a devaluation will have a temporary effect on the trade balance. The trade balance will improve to the extent that the real balance effect will depress absorption and, through price increases, will reduce the real value of household wealth. Contrary to the Keynesian model, even in the absence of a devaluation, the full flexibility of prices guarantees that the automatic adjustment mechanism will work quickly and effectively to remove any disequilibrium in the economy (and there would be no need for devaluation).

In contrast to traditional views discussed above, several theoretical arguments have been put forth to explain why a devaluation can have a negative effect on output. The emphasis was initially put on the demand side. Diaz-Alejandro (1963) was among the first to raise this possibility.11/ He shows that a devaluation may lead to a reduction in real income using a model with relatively price-inelastic exports, imports and consumption functions based on higher propensities for non-wage earners. This result is produced by transferring real income from

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11/ See Cooper (1971).

workers who receive a fixed nominal wage, to capitalists with higher propensities to save factor income. Krugman and Taylor (1978) have extended and formalized this view. They argue that a devaluation can be contractionary to the extent that it generates, through its effects on the price level, a negative real balance effect. This, in turn, will result in lower aggregate demand and, under some circumstances, lower output.12/

In addition to these demand effects, there are a number of supply-side channels through which devaluation can be contractionary (besides being inflationary). Bruno (1979) makes two arguments to support the view that, in a developing country, a devaluation will increase firms' input costs and need for working capital. First, he argues that inputs for manufacturing are imported and not easily substituted domestically. Bruno also states that a devaluation will increase the need for working capital for firms whose acquisition of working capital is dependant on banks subject to rationing. This will increase interest rates and the demand for funds, which may lead firms to reduce production. Thus, the positive effect of increased production will be offset by higher relative prices. If relative prices are delayed, in the short run, it is possible that the negative effect on aggregate supply may prevail. Van Wijnbergen (1986) developed a model with intermediate goods and a financial (curb) market. Like Bruno, he stresses the impact of a devaluation on the domestic currency costs of imported inputs, as well as its negative effect on firms' working capital. He also discusses the effect of parity changes on external debt repayment and on nominal wages in the presence of wage indexation.13/ Finally, Buffie (1986) warned against the negative effect on supply which could be compounded, in the long run, by a nominal devaluation that depresses investment because of a higher cost of imported capital equipment.

How useful are these models in understanding the impact of devaluation on SSA economies? In other words, how relevant are the assumptions of these models for SSA countries? The assumption of full employment in the monetarist model is weak in the SSA context because structural and cyclical factors keep the economy in under-capacity utilization. Often, SSA countries cannot take full advantage of price changes because of constraints such as poor

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12/ Krugman and Taylor results rely on very restrictive assumptions (exports are fixed, the marginal propensity to save of the government is equal to one, and so on).

13/ See Buffie (1984).

transportation facilities, inefficient research and, extension services. The Keynesian approach is also lacking, given the disproportionate attention to demand factors.

Arguments supporting the contractionary devaluation hypothesis need to be examined. In the case of the demand-side approach, it is important to consider the underlying elasticities in SSA countries. Are the elasticities lower in SSA than in other countries? For the supply side approach, the negative effect due to intermediate goods has diminished due to an increase in production of primary products in most SSA countries. Intermediate inputs in agriculture are not domestically substitutable, but are used in large farms that are generally financially better off. Therefore, these inputs are not subject to rationing.

The impact of sustained devaluation on SSA economies is an empirical matter, yet there has been little empirical work done on the contractionary effect of exchange rate changes on economic activity in developing countries. Empirical work exists on Latin America, but few studies have been done on the SSA region. Interestingly, there are several studies on the supply response of agriculture based on SSA countries. In the study of effects of devaluation in SSA countries, there is an overlap between analysis of devaluation on economic performance and analysis of the supply response of agriculture to devaluation.

B. Empirical Studies on Contractionary Devaluation in Developing Countries

A number of methodologies have been presented in the literature to analyze the effects of devaluation on economic performance.14/ The first approach examines changes in country performance at the time of devaluation, usually referred to as the "before and after" approach. The flaw of the "before and after" approach is that it relies on the assumption that other things are being held equal which is highly implausible. The second approach, the so-called "control group," in principle, overcomes the shortcoming of the "before and after" approach by distinguishing the effect of devaluation from other factors on output. The "control group" approach compares the performance in devaluing countries with performance in a reference group of non-devaluing countries to estimate what would have happened in the devaluing countries had

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14/ See Goldstein and Montiel (1986) for a formal presentation of these methodologies.

devaluation not occurred. The third approach applies econometric methods to time-series to determine the impact of the exchange-rate changes on various performance variables. This approach has a number of limitations since the specification of the output equation estimated is essentially ad-hoc. Finally, the fourth, somewhat less direct approach, uses simulation models or reduced-form equations to analyze the effect of the exchange rate on output. This approach has a major advantage—it gives more information on the short run dynamics of the effects of a devaluation. However, the results rely often on "guess estimates" of values of elasticities and parameters.15/

Table 5 is a matrix giving an overview of empirical studies done on the effects of devaluation. In a seminal paper, Cooper (1971) employs the **"before and after"** approach to examine 24 devaluations between 1959 and 1966, involving 19 developing countries (none of which belongs to SSA). The study assessed the extent of the response (one year before and one year after) of various elements of aggregate demand, balance of payments and inflation. Cooper's results show that some elements of aggregate demand demonstrate contractionary tendencies after devaluation. Results show, however, that the trade balance and the balance of payments did improve in most cases. While Cooper attempted to control for changes in the international and domestic environment when measuring responses to devaluation, his focus on one-year changes was limiting. Typically, a devaluation cannot be expected to have its principal effect in the year after its implementation.

Kamin (1988) is one of the first studies based on the **"control group"** methodology. This study follows the evolution of different variables for seven years (the year of the devaluation, three years before and three years after). Kamin's research exploits data for 50 to 90 devaluations out of a sample of 107 (including 22 devaluation episodes in twelve SSA countries) that took place between 1953 and 1983. Kamin's results show that devaluation has a positive or at least no effect on output, but a sharp and significant decline in output growth is registered by the devaluing countries, in the year preceding the devaluation. This lower rate

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15/ Empirical studies based of the "before and after" approach include Diaz Alejandro (1965), Cooper (1971), Krueger (1978). Regression analyses are applied in Khan (1974), Goldstein (1974), Miles (1976), Edwards (1986), Edwards (1989) and Faini (1992). Results presented in simulations models are presented in Gylfason and Shmid (1983),Gylfason and Risager (1984), Solimano (1986), Branson (1986), Gylfason (1991), and Agenor (1991).

Table 5: Studies on the Effects of a Devaluation

AUTHOR	*COVERAGE*	*METHOD*	*DEVALUATION EFFECT*
Cooper (1971)	24 devaluations (1959-66) in LDCs (Africa: Morocco, Tunisia)	Control group approach	Contraction; trade balance and B&P improve
Sheehey (1986)	16 Latin American countries	Econometric approach	Highly contractionary
Edwards (1986b p. 138)	12 devaluations in LDCs (1965-80) Africa: South Africa	Econometric approach (dependent economy model with intermediate inputs, wage indexation and foreign debt)	Short-run contraction;long- run neutral
Ahluwalia and Lysy (1981)	Malaysia	Macromodel	Contraction when export demand elasticity less than 0.5
Gylfason and Schmid (1983)	5 DCs (Brazil, India, Pakistan, Philippines, Turkey) and 5 DCs	Macro-simulation model (intermediate goods and open economy)	Devaluation is expansionary in 8 of 10 countries. Long-run neutrality
Gylfason and Risager (1984)	8 LDCs, 7 DCs (Africa: Kenya, Morocco)	Macro-simulation model	Contraction in LDCs; expansion in DCs; improved CA all
Hamilton (1987)	Australia	Macromodel	Short-run expansion; long-run contraction
Diaz-Alejandro (1965)	Argentina	"Before and after" approach	Short-run contraction
Kamin (1988)	107 devaluations in LDCs (SSA: Botswana, Burundi, Ghana, Rwanda, Sierra Leone,Somalia, Sudan, Swaziland, Tanzania, Zambia)	Control group approach	Expansion or no effect. Contraction occurs before devaluation and can last after devaluation
Edwards (1989a) (1989b p.320-24)	18 devaluations in Latin America (1962-1982)	Control group approach	Observed decline in growth when observed not a consequence of devaluation but rather due to accompanying measures
Faini and de Melo (1990)	Large sample of LDCs	Econometric approach	No effect on the trade balance and output for exporters of primary goods.In the long run expansionary for exporters of manufactured goods
Gylfason and Radetzki (1985)	12 LDCs (SSA: Sudan, Botswana, Burundi, Ethiopia, Malawi, Rwanda, Somalia, Sudan, Tanzania)	Macro-simulation model	CA improves, decline in output if wages are downwards inflexible, specially if there is wage indexation. Evidence of contractionary effects in LDCs
Donovan (1981)	12 IMF-supported devaluations (1970-76)	Control group approach	Export growth improves in the long run, though not initially (J curve). Import growth rise but less than export growth

AUTHOR	*COVERAGE*	*METHOD*	*DEVALUATION EFFECT*
Donovan (1982)	78 IMF-supported devaluations (1971-80)	Control group approach	Output fall more than LDCs average in one year comparisons but by less in 3 years comparisons
Gylfason (1987)	IMF supported programs (1977-79)	Control group approach	B&P improves, effect on output is inconclusive
Khan (1990)	69 LDCs (1973-88)	Control group approach	Negative effect on growth (however the coefficients are not statistically significant)
Solimano (1986)	Chile	Macro-simulation model	Contraction in the short-run and in the medium-run
Branson (1986)	Kenya	Macro-simulation model	Contractionary effect
Roca and Priale (1987)	Peru (1977-78) and (1980-82)	Macro-simulation model	Contractionary effect due to increase in cost of working capital of firms
Agenor (1991)	23 LDCs (1978-87) (SSA: Burundi, Cameroon, Gabon, Malawi, Nigeria, Sierra Leone, Togo, Zaire and Zambia)	Econometric approach	Anticipated depreciation is contractionary while unanticipated depreciation is expansionary
Bhagwat and Onitsuka (1974)	LDCs (1960-70)	"Before and after" approach	Positive export response in the long-run, little indication of significant import response
Edwards and Santella (1992)	48 devaluations in LDCs (SSA:Ghana, Zaire)	Control group approach and econometric approach	Devaluation when accompanied by restrictive and consistent macro-policies are effective
Taylor (1979)	22 countries	Econometric approach	Support of expansionary hypothesis
Salant (1976)	101 devaluation in LDCs and DCs	"Before and after" approach	Balance of trade improves only in 46 cases, B&P improves in 76 cases

appears to have been maintained unchanged throughout the year following the devaluation. Insubsequent years, the effects of the devaluation on output are positive. Edwards (1989a) is another study that uses the control group approach. Analyzing devaluation episodes in Latin America, Edwards found contractions of output in the periods before and after the devaluation. Edwards points out that negative output performance in the short run may have been the consequence of underlying policies that accompanied the devaluation, rather than devaluation itself.16/

Edwards (1986) is one of the few empirical works using econometric methods. His empirical analysis was based on estimating a reduced-form real-output equation using data for twelve developing countries (the only African country included was South Africa).17/ The results show that, with other things being held equal, devaluation has a negative short-run effect on output. After one year, however, this negative effect on output was completely reversed. In the long run, devaluations were found to be neutral. Sheehey (1986) is another study which uses the econometric approach. Sheehey analyses devaluation episodes in twelve Latin American countries, focusing on the short run. His results provide evidence which supports the contractionary hypothesis. In a recent study, Agenor (1991) also used an econometric approach to analyze devaluation episodes in 23 developing countries—among them nine SSA countries—over the period 1978-87. His output equation was based on a rational expectations model. Contrary to the results produced by Edwards (1986) (who used the same approach), Agenor's results show that an anticipated depreciation of the real exchange rate has a negative effect on economic activity, while an unanticipated depreciation has a positive impact on output. Moreover, the contractionary effect of anticipated depreciation remains significant, even after a year.

A paper by Faini and de Melo (1990) shows that, for primary-goods exporters, a real devaluation has no effect on the trade balance, and thus on output, whereas for manufacturing exporters a real devaluation does have an effect. Employing the econometric approach, Faini and de Melo argue that this result is due to the lack of opportunity to expand exports which are

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16/ See Donovan (1981).

17/ The variables included in the right hand side were: money growth surprises, government expenditure, terms of trade and real exchange rates (a problem of auto-correlation can occur due to the endogeneity of the real exchange variable).

concentrated in so few primary commodities. This argument is relevant for SSA countries where export concentration is high. As of 1988, two commodities provided at least 60 percent of export earnings in 30 out of the 43 SSA countries for which export data by commodity are available. (Table A4). Faini and de Melo's results assume that the terms of trade are given. It is important to note, however, that in the econometric approach, it is difficult to determine which channel suggested by the theory is more important since the analysis focuses on the net effect of devaluation on output.

Evidence from macro-simulation models provide information that distinguishes the effects of devaluation on output through different channels. Gylfason and Risager (1984) provides evidence from cross-country macro-models on the impact of devaluation on real output. Their study shows that, while a devaluation is likely to have a positive effect on output in developed countries, it is generally contractionary in developing countries. Using the same approach, Gylfason and Radetzki (1985) obtained a similar result: contractionary devaluation is more likely to occur in developing countries than in developed countries—even more so when demand elasticities are low.18/

To summarize, many studies exist on the impact of devaluation on output in developing countries. (See Table 5). The conclusions are as follows. First, contractionary devaluation is true in some countries but not in others. Second, where contractionary devaluation occurs, it is short lived; in the long run, devaluation effects seem neutral. Third, contractionary devaluation is more likely to occur in developing rather than in developed countries—more so when demand elasticities are low. Finally, the impact of devaluation on output appears to be less effective (or even ineffective) in countries exporting primary products than in countries exporting manufactured goods.

C. Empirical Evidence on Contractionary Devaluation in SSA Countries

Are conclusions drawn from studies done on developing countries in general relevant for SSA countries? There is *a priori* belief (especially among some policymakers in Africa) that

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18/ Although Gylfason and Risager's study emphasizes the role of interest rates, the Gylfason and Radetzki's paper emphasizes the role of wage indexing.

devaluation in SSA economies results in output contraction and high inflation. A few empirical studies seem to confirm this. For example, a study conducted by Demeke (1992) on a sample of 30 SSA countries for the period 1980-88 concluded that the effects of currency depreciation on output and export was at best insignificant and that it triggered a high rate of inflation. The effects on the current account balance were positive but due largely to import compression. Two methodologies were used in this study: the before-after approach and the econometric techniques. However, using data from the period 1965-89, Balassa (1989) analyzed SSA economic performance in general and agriculture exports in particular. He found that a 1 percent change in the real exchange rate is associated with a 0.8 to 1 percent change in the ratio of exports to output in SSA countries. Balassa also found that the response of the export-output ratio to the real exchange rate changes for SSA countries is higher than for other parts of the world. His evidence on export shares argues against the prevailing pessimistic export position.19/ Using a CGE model for two African countries, Madagascar and Niger, Dorosh (1994) and Dorosh, Essama Nssah, and Samba-Mamadou (1994) found positive association between real exchange rate depreciation and changes in real exports. A RER depreciation of 10 percent was associated with an increase in real exports of 5.9 percent in the case of Madagascar and 3.4 percent in the case of Niger.

In SSA economies, the tradeable sector is constituted essentially by the agriculture sector. For this reason, supply response by tradeables will be measured by the supply response of the agricultural sector. Two caveats should be borne in mind. First, imports of manufactured goods are important, especially the essential products that cannot be domestically produced. Second, tradeables, on the export side, are made up of not only agricultural products, but also non-primary commodities (including mineral products and oil). It is believed that the results are essentially the same for mineral producing countries as for agricultural producing countries except that the underlying elasticities involved are lower.

Although SSA countries differ greatly in their geographical and physical conditions, weather patterns, and cultural heritage, the similarity of their economic structures is striking. In most SSA countries, agriculture dominates the economy and for many, accounts for 30 to 60

19/ Balassa's results rely on regressions having low coefficients of determination (the higher is equal to 0.092), and, therefore, must be interpreted with caution.

percent of their Gross Domestic Product. Except where metals and minerals constitute a country's main export, agricultural commodities account for two-thirds or more of their export earnings.20/ In some cases—Burundi, Chad, Côte d'Ivoire, Mali, Rwanda, Somalia, Sudan and Uganda—agricultural products are virtually the only merchandise export.21/ Thus, a knowledge of the agricultural sector's responsiveness provides the means to gauge the effects of real exchange rate depreciation on overall economic performance for two reasons: the nature of the agriculture sector, it is usually more labor-intensive and less import-intensive than the rest of the economy; and the agriculture sector's importance in the tradeables sector, and in the overall economy.

Supply Response of Macroeconomic Interventions on Agriculture.

Macroeconomic policies have a direct and an indirect impact on the agricultural sector.22/ Krueger, Schiff, and Valdes (1988) show that the indirect effects on agriculture generally dominate the sectoral direct effects of price interventions in SSA countries such as Ghana, Côte d'Ivoire and Zambia. Thus, typically, the empirical work on the supply response of agriculture is measured by numerical estimates of elasticities of aggregate, sub-sectoral (cash crops and food crops), and individual crop supply response to price and non-price variables. The values found for the underlying elasticities for the developing countries are compared to the corresponding elasticities for the SSA countries.

Supply Response of Agriculture in a Single Crop Supply Elasticities.23/

Price incentives are an important element of any exchange rate policy aimed at stimulating agricultural supply. Measuring the price elasticities of agriculture is necessary to make a realistic

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20/ Congo, Gabon, Cameroon and Nigeria (oil); Niger (uranium); Sierra Leone (diamonds); Togo (phosphates); Zaire and Zambia (copper); Liberia and Mauritania (iron ore).

21/ Oil producing countries and countries whose principal exports are minerals are different cases. These cases will be examined in the Annex Country Case Studies of this report.

22/ For example, agriculture can be taxed relative to import substitutes through a direct effect (export taxes and import protection policies) or agriculture can be taxed indirectly through the overvalued exchange rate.

23/ For a discussion on the caveats associated with the estimates of the elasticities of supply response, see Oyejide (1990).

assessment of the supply response of agriculture. However, it is useful to keep in mind that most empirical works are based on a partial equilibrium set up. Non-price incentives, such as policies affecting infrastructure, roads, and so on, are also important.24/ Studies of the supply response on SSA agriculture have discussed whether or not the African smallholder responds normally, quickly and efficiently to relative price changes, or whether the institutional constraints limit their response. Empirical evidence exists for SSA countries, assembled by Helleiner (1975) and Bond (1983), which shows that the response of single crop output to price incentives is high. Tables A1 and A2 summarize the elasticity ranges for SSA countries. The evidence shows that farm producers in SSA respond to price incentives as any other farm producer in the developing world—they behave rationally.

FOOD CROPS AND CASH CROPS SUPPLY ELASTICITIES. It is quite useful to distinguish between cash crops and food crops because of the large difference in the marketing magnitude of their inputs. Statistics are generally available for cash crops because farmers record the sale of their harvests when their output is either exported or processed in factories. In the case of food crops, however, traded production is often too small, making the availability of statistics inconsistent. In general, supply elasticities of food crops are low as can be inferred by Krishna (1963) from his study on single crop supply elasticities. In another, more recent study, Jaeger (1991) combined cross-section and time-series data for 43 SSA countries and assessed the responsiveness of prices, policies, natural disasters, and rainfall on the supply of exports and food crops. Natural disaster was represented by the percentage of population affected by disasters, rainfall was proxied with the residual from estimating a regression trend line for cereal yields.25/ In the short run, annual export crops price response was found to be elastic (above 0.9), and export supply elasticities with respect to the real exchange rate for annual crops

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24/ Most of the literature on supply response in SSA dealing with a single commodity includes non-price factors variables. For example, Oni (1969), Adesimi (1970), and Maitha (1970), (see the note in Table A1), among others, include a time trend variable to represent either technology or infrastructure, or population; the use of proxies for the weather variable are also common. However, there are factors that influence price responsiveness which are not considered in these models. In particular, the level of prices received by farmers may not be as important as the timeliness of their receipt, or the political stability, or the rural infrastructure.

25/ The use of this proxy for rainfall was based on the assumption that for most countries, variations in average yields will result primarily from variations in weather. Furthermore, for the regression equation it is assumed that this proxy is not correlated with the dependent variable. But, if this proxy is a function of the dependent variable, then the estimates are biased.

exported were found to be about 0.6. The possibility that export agriculture may crowd out food production was examined. It appears that growth in agriculture exports is not at the expense of food production. Food production is positively correlated with export crop prices and real exchange rates, suggesting complementarity.

AGGREGATE SUPPLY ELASTICITIES. Even when individual crop-supply response is strong, it does not eliminate the ambiguity of the aggregate agriculture supply response. If the aggregate elasticity is low, then export crops may increase at the expense of food crops. Econometric evidence confirms that the elasticity of aggregate agricultural response is positive, so cash crops are not obtained at the expense of food crops. However, there is little reliable or robust data estimating aggregate agricultural supply response for SSA countries. This limited evidence is presented in Table A3 and is drawn from Bond (1983), and Berthelemy and Morrisson (1989). In Table 6 Chhibber (1988) provides data on available estimates for long-run elasticities for developing countries derived from at least four types of models. These models include cross-country, cross-section (farm households), inter-sectoral general equilibrium, and time-series. In general, the first two models produced relatively high estimates of elasticities. (Cavallo and Mundlak (1982), and Peterson (1988)). Cross-section models give lower values, yet they suffer from the unreliability of farm-level price data. Time-series models rely directly or indirectly on the Nerlovian (1958) dynamics-of-supply model.

As noted by Chhibber (1991), elasticities of aggregate supply response in agriculture in SSA countries seems to be comparable to those in other parts of the developing world. One important paper written by Pritchett (1992) must be taken into account when considering the effects of a tradeables supply response. Pritchett shows that in an economy subject to foreign exchange rationing, like many economies in SSA, a real depreciation will affect exports in the "normal" sense, but imports may exhibit a perverse response. If the flow of total imports is constrained by the availability of foreign exchange, a real depreciation will have two conflicting effects: on the one hand, it will increase the price of imported goods, and on the other hand, it will increase the export receipts and, through this channel, induce higher demand for imports. Empirical evidence provided by Moran (1988) and Faini et al. (1992) indicates that the effect on imports can be quite strong and therefore account for the overall low responsiveness of the trade

balance and output. Additional supporting evidence is provided by Faini (1991) for six less developed countries (among them, Kenya, Malawi, and Zambia).

Table 6: Long-run Estimates of Aggregate Agricultural Supply Elasticity in Developing Countries

Model	*Range of Estimates*
Cross-farm	(-0.02) - 0.15
Time-series	0.13 - 0.78
Inter-sectoral general equilibrium	0.09
Cross-country	1.27 - 1.66

Source: Chhibber, (1988) p. 10.

THE FALLACY OF COMPOSITION ARGUMENT.

The fallacy of composition "presumes that markets would not be able to absorb all of the exports that would materialize if developing countries" jointly promoted an export-led strategy (for example, by a series of devaluations). Furthermore, if such markets were found, "they would be closed by protectionist measures, provoked by the import penetration and outcries of market disruption" (Bhagwati, 1988). The fallacy of composition argument takes account of the concept of aggregate demand behavior. In other words, it does not assume that countries are small and therefore international prices are fixed. Effectiveness of a devaluation in improving the external balance depends on the behavior of international competitors. It is often argued that, if a wide range of developing countries—commodity-exporter countries—devalued their currencies to increase the volume of their exports, the consequent expansion in the world commodities supply would deteriorate the country's terms of trade. A recent paper by Faini et al. (1992) argues that the so-called fallacy composition argument applies to manufacturing products (in developing countries) as well. Can it therefore be inferred that the fallacy composition argument is relevant to SSA countries (and to various sectors in SSA)?

Agricultural exports from SSA are concentrated in a few products.26/ The share in world exports of these commodities is generally low, with the exception of coffee, tea, cotton, sisal, groundnut oil and tobacco (Table 7.) Also, SSA economies are generally vulnerable to world prices.

Several studies have been recently done to empirically shed light on the debate. Akiyama and Larson (1993) estimated the elasticity of export revenue with respect to export volume for the main primary commodity exports of the region. Their results show that cocoa is the only commodity for which increases in export volume causes export revenue to fall. All other commodities - coffee, sugar, tea, vegetable oils, cotton, tobacco, sisal, oranges, and pineapples have positive elasticities which means that increases in export volumes lead to increases in export revenues. Investigating the cotton market, Coleman and Thigpen conclude that an adding-up problem does not exist for cotton. In another study done by the World Bank (1993), a comparison of the effects on export earnings of a 5 percent increase in total African exports of cocoa, coffee and tea revealed that only for cocoa, and that too in the short-run, does Africa face the "fallacy of composition". Coleman, Akiyaman and Varangis (1993) studied the effects of structural adjustment programs in Sub-Saharan Africa on the cocoa sector using a global econometric model. They focussed on Ghana and Nigeria that are major cocoa producers that undertook structural adjustment programs. They find that the impact on world cocoa prices was relatively small. In examining nine cocoa-producing countries, Panagariya and Sciff (1991) showed that a depreciation can lead, in the short run, to lower combined export revenues for all cocoa producers with some winners and some losers. In the long run, the impact is positive but small.

It is concluded that simultaneous devaluation by several SSA countries is unlikely to sufficiently reduce world commodity prices, and thus to reduce their total export earnings.27/ The one possible exception is cocoa producers, "who would face a temporary decline in the short run" (DeRosa and Greene, 1991).

26/ In contrast, the products contributing to import earnings are much less concentrated.

27/ Chhibber (1991) shows evidence of the fallacy composition argument, but states that elasticities are such that export revenues will increase in spite of the argument.

Table 7: Export Values and Shares of World Exports for Selected Agricultural Commodities Elasticity in SSA Countries (US$ millions, %)

	1980		*1991*	
Product	*Export Value*	*Percent of Exports*	*Export Value*	*Percent of Exports*
Cocoa Beans	2055.3	72.5	1410.0	67.2
Palm Oil	79.8	3.9	74.0	2.7
Sisal	63.4	48.4	18.6	40.4
Coffee	2794.4	22.4	1137.0	15.0
Groundnut Oil	89	23.9	92.3	31.9
Tea	281.6	14.0	385.4	15.5
Cotton	1170.6	15.0	937.8	11.1
Tobacco	339	8.9	837.3	14.6
Groundnut	79.5	15.0	22.7	2.7

Source: UNCTAD Yearbook, (1987 and 1993)

4

Empirical Evidence from Sub-Saharan Africa

This chapter addresses three empirical questions. One, is to investigate the long-run effects of nominal devaluations on the real exchange rates. Two, is to test the effects of real depreciations on per capita real GDP growth in the transitional period to steady-state. Three, is to analyze the causal relationships and the directions of causality between nominal devaluations and money growth, and between real devaluations and real exports growth.28/

In a sample of twenty-two SSA countries29/ during the period 1971-1991, we find a statistically significant long-run relationship between nominal devaluations and real depreciations. We find real depreciations to have a neutral effect on real per capita GDP growth. Further, we find significant causal relationships that run from money growth to inflation, from output growth to inflation, from inflation to nominal devaluations, and from inflation to money growth. Finally, we cannot find any causal relationship between real depreciations and real exports growth.

A. Real and Nominal Devaluations Dynamic

It is commonly believed that economic policy weaknesses in general and expansionary macroeconomic policies in particular are responsible for the poor economic growth in the countries of Sub-Saharan Africa (SSA) during the past two decades. It has been argued that one of the channels through which growth can be hurt the most is through the decline of the external

28/ Causality is in the framework of Granger-Causality (Granger, 1969 and 1980).

29/ The countries are Benin, Botswana, Ivory Cost, Cameroon, Congo, Gabon, Ghana, Gambia, Kenya, Lesotho, Madagascar, Mali, Mauritania, Mauritius, Malawi, Niger, Nigeria, Rwanda, Senegal, Togo, Zaire, and the Zambia. The choice of this sample is dictated by the availability of the data.

competitiveness caused by overvaluation of the real exchange rate (RER).30/ Given the need to correct overvaluation in the RER, and hence to improve external competitiveness and resume growth in the region, many countries in the region devalued their currencies in the 1980s.

The aim of this paper is to investigate the effectiveness of nominal devaluations in inducing permanent real depreciations of the RER in SSA. Using regression analysis, Edwards (1988) has shown that nominal devaluations are effective in bringing about real depreciations for a diverse group of developing countries. In a theoretical paper Khan and Lizondo (1987) have shown that the effectiveness of nominal devaluations on the RER in the long run depends on supporting restrictive fiscal measures (and by implication monetary measures) to accompany the devaluations.31/ *An implication is that when analyzing the effectiveness of devaluations on the RER, the effects of monetary and fiscal policies have to be accounted for.*

Theoretical and Empirical Considerations.

The analytical framework used is an extension of Meltzer (1993). Let the actual RER has both permanent and transitory components given by:

$$RER_t = RERP_t + U_t, \qquad (1)$$

where $RERP_t$ is the permanent component and U_t is the transitory disturbance component. Furthermore, the current permanent value is a weighted average of the last period's RER and any persistent effect of fiscal and monetary policies. Let F_t be a vector that consists of fiscal deficits and real money balances. Then the RERP is given by:

$$RERP_t = \beta RER_{t-1} + (1-\beta) F_t + v_t. \qquad (2)$$

Combining equations (1) and (2) gives:

where e_t is an error term.

30/ Ghura and Grennes (1993) have shown that the RER was overvalued in several countries of the region during the period 1970-1987, and that macroeconomic performance was adversely affected by overvaluation. See also the papers by Agarwala (198_), Edwards (198_) and Cottani et al. (1990) for empirical evidence of the deleterious effects of the overvalued real exchange rates on economic performance.

31/ See also the papers by Berglas and Razin (1973) and Edwards (1989).

$$RER_t = \beta\, RER_{t-1} + (1-\beta)\, F_t + e_t, \qquad (3)$$

Let the real money balances be M/P, where M is the stock of money and P is the price level. To separate the effects of prices from the effects of money on the RER, Meltzer (1993) totally differentiates the real money stock to obtain:

$$\Delta \left(\frac{M}{P}\right)_t = \frac{\Delta M_t}{P_{t-1}} - \frac{\Delta P_t}{P_{t-1}} \left(\frac{M}{P_{t-1}}\right). \qquad (4)$$

The first term in equation (4) is the real value (expressed in past prices) of the current change in nominal money balances. The second term is the revenue from the inflation tax on real money balances. The inflation tax captures the fiscal implication of monetary policy. Taking the first difference of equation (3) and substituting $\Delta(M/P)_t$ by the expression in equation (4) gives:

$$\Delta RER_t = \beta\, \Delta RER_{t-1} + (1-\beta) \left[\frac{\Delta M_t}{P_{t-1}} - \frac{\Delta P_t}{P_{t-1}} * \frac{M}{P_{t-1}}\right] + \epsilon_t. \qquad (5)$$

The RER is measured as $(S.P^*)/P$, where S is the spot nominal exchange rate, defined as the home currency price of the U.S. dollar, P is the domestic GDP deflator, and P^* is the U.S. wholesale price index. To estimate the effects of nominal devaluations on the change in the RER, equation 5 is augmented by the contemporaneous and k lags of a variable measuring nominal devaluation (NDEV). NDEV is defined as the percentage change in the nominal exchange rate. We also include the expected change in the cost of holding money, r_t as an additional explanatory variable to capture the effects of real interest rates on the change in the RER. This variable is measured as the $\Delta(\text{inflation})_{t-1}$, where inflation is the rate of growth of the GDP deflator defined as the percentage change of the price level, P_t. We do not have a complete time series for the deficits, therefore we do not include them in the regression. This yields the following equation that we test:

$$\Delta RER_t = \delta_0 + \delta_1 \Delta RER_{t-1} + \sum_{i=0}^{k} \gamma_i (NDEV)_{t-i} + \delta_2 \left(\frac{\Delta M_t}{P_{t-1}}\right) + \delta_3 \left(\frac{\Delta P_t}{P_{t-1}} * \left(\frac{M_t}{P_{t-1}}\right)\right) + \delta_4 r_t + q_t. \qquad (6)$$

Empirical Results.

The number of lags k is determined by two methods--the Akaike (1974) Information Criterion Statistic (AIC), and Hall's (1992) General-to Specific method, where a general lag structure is fitted (4 in this paper) and an F test is used to test backward.32/ The optimal lag length k is found to be three. Equation (6) was estimated by OLS for twenty countries over the period 1971-1991 with pooled time-series and cross-section data.33/ The regression is tested and corrected for hetroskedasticity.34/ The results are:

$$\Delta RER_t = \underset{(1.34)}{0.05}\Delta(RER)_{t-1} + \underset{(44.61)^*}{0.88}(NDEV)_t \underset{(-1.42)}{-0.05}(NDEV)_{t-1} - \underset{(-2.31)^*}{0.05}(NDEV)_{t-2} \underset{(-2.358)^*}{-0.04}(NDEV)_{t-3}$$

$$\underset{(-24.66)^*}{-0.03}(INFTAX) \underset{(-1.50)}{-0.001}(\Delta M_t/P_{t-1}) + \underset{(0.62)}{0.02}(r_t).$$

$$R^2 = 0.88 \quad F = 295.90^* \quad N = 339.$$

The t ratios are in parentheses. The estimated coefficient on ΔRER_{t-1} is significantly different which indicates that there is no significant persistent in real devaluations. The estimated coefficient γ_0 gives the contemporaneous relationship between nominal devaluation and real depreciations and is equal to 0.88. It is found to be statistically significant at the 5 percent level. This coefficient implies that a 10 percent nominal devaluation at time t yields about 8.8 percent real depreciation at time t, other things remain unchanged The other estimated coefficients γ_1, γ_2, and γ_3 are all negative (-0.05, -0.05, and -0.04, respectively) and (with the exception of γ_1) statistically significant at the 5 percent level. Their magnitudes, however, are very small. We test the null hypothesis that the sum of all contemporaneous and lagged nominal devaluation terms is equal to zero, (H_0: $\Sigma^k_{i=0}\ \gamma_i = 0$). The F value is found to be

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32/ We test for the significance of the fourth lag, then the fourth and the third, the fourth, third, and the second, and finally, all four lags together.

33/ The list of countries included in the sample are in footnote 2 except for Rwanda and Lesotho, where complete time series data cannot be found.

34/ The Breusch-Pagan and the White tests are used to test for hetroskedasticity. The correction is accomplished by scaling all variables including the intercept and instruments in the regression by the estimated standard deviations of the residuals for each country.

584.2, which leads to the rejection of the null at the 5 percent level. This implies that there exists a long-run effect of nominal devaluations on the real exchange rate. The sum of the coefficients $\gamma_i/1-\delta_i$ (i=1, 2, 3) gives the long-run impact, and is computed to be 0.77. This implies that a 10 percent nominal devaluation at time t gives a 7.7 percent real depreciation in the long run, holding all other things equal.

The estimated coefficient on the inflation tax (-0.03) is statistically different from zero at the 5 percent level. The negative sign implies that the inflation tax that results from expansionary monetary policies results in an appreciation of the real exchange rate. A 10 percentage points increase in inflation tax leads to a 0.3 percentage points appreciation of the real exchange rate. The estimated coefficient on the real money supply is also negative but statistically insignificant at the 5 percent level. The proxy for the real interest rate is statistically insignificant at the 5 percent level.

B. Real Depreciations and Real Economic Growth

There is a general agreement about the extent of poor growth performance of most SSA countries. Data of sixteen out of twenty-two countries in the sample show a poor economic growth in the 1980s compared to that in the 1970s (see table A7). Fifteen countries have experienced negative growth rates during the period 1981-1991. There are both exogenous and endogenous explanatory factors for this poor performance. Among the endogenous factors are the distorted macroeconomic policies pursued by many countries. To improve the performance of their economies, many African countries embarked on policy reforms with the support of the Bank and the IMF. Most of the reform programs adopted included devaluations as a policy variable. The question addressed here is how do real devaluations have affected GDP growth? The next section focuses on deriving a theoretical model, where real depreciation of the exchange rate is an additional argument in the growth function.

The Theoretical Approach.

Devaluations of domestic currency give a signal to producers about the authority's intention for openness. If devaluations induce real depreciations then producers have the incentive to produce more goods. Therefore, we can think of real devaluations as a factor affecting productivity. On the other hand, real devaluations raise the price of importable goods (and their substitutes), which generates inflation and discourage imports. The increase in the price of importable goods generates inflation and inflation expectations, which have negative impact on real output growth because it reduces the efficiency of the

price system. Thus, inflation distorts the allocation of resources decisions.35/ Bruno (1979) and Van Wijnbergen (1986) argue that in countries where factor inputs are imported, a currency devaluation results in an increase in production costs, hence, lowers output. Theoretically, it is not clear what would the effect of real devaluations be on real output. Edwards (1986) showed that real depreciations have neutral effect on real output.

The traditional neoclassical growth model (Solow, 1956) explains changes in the steady-state level of real income per capita as a function of changes in savings rates, population growth rates and total factor productivity (level of technology). Recent growth literature treats technology as an endogenous variable (Barro (1991) and Lucas (1988)). Capital is assumed of two parts, physical capital and human capital. Mankiw, Romer, and Weil (1990) introduced a model, where human capital accumulation enters as an additional argument in the Solow model. Using this model, we argue that real devaluations can affect total factor productivity. We test the null hypothesis H_0: real devaluations have zero effect on per capita real output growth against the alternative H_1: real devaluations have non-zero effect on per capita real output growth.

We follow Mankiw, Romer and Weil by assuming a Cobb-Douglas production function. Production at time t is given by:

$$Y = K^{\alpha} H^{\beta} (ZL)^{1-\alpha-\beta} \qquad 0 < \alpha < 1 \,, \alpha + \beta < 1, \tag{7}$$

where Y is output, K is physical capital stock, H is human capital, L is labor, and Z is the level of technology. The parameters α and ß are the shares of physical and human capitals in income respectively. Labor is assumed to grow exogenously at a rate n:

$$L_t = L_0 e^{nt}. \tag{8}$$

The level of technology is assumed to grow exogenously at a rate g. In this paper we also assume that the level of technology is affected by the real exchange rates, R.

$$Z_t = Z_0 e^{gt} f(R) . \tag{9}$$

To simplify things, we assume a simple functional form for f(.):

35/ For further discussion about the negative impact of inflation on economic growth see for example, Cecchetti (1986), Leijonhufvud (1980), Friedman (1986), Carlton (1982), Parks (1987), and Fischer (1993).

$$Z_t = Z_0 e^{gt} R^{\theta}, \tag{10}$$

where the elasticities of technology with respect to the real exchange rate is θ. In the next section, we test H_0 with respect to θ.

Let k be defined as the stock of capital per effective unit of labor (k= K/ZL). Let h be defined as the stock of human capital per effective unit of labor (h=H/ZL). Let y be defined as the level of real output per effective unit of labor (y=Y/ZL). The fraction of real income spent on physical capital is S_k and that spent on human capital is S_h. The physical and human capital stocks evolve according to:

$$\begin{aligned} \dot{k} &= S_k - (n+g+\delta)k \\ \dot{h} &= S_h - (n+g+\delta)h, \end{aligned} \tag{11}$$

where it is assumed that both types of capital depreciate at a rate δ. The steady-state is defined when both types of capital are constant in efficiency units. Note that the returns on the two types of capital are not the same in the steady-state because the savings rates are assumed exogenous. The equilibrium values of physical and human capital stocks are k^* and h^* and given by:

$$\begin{aligned} k^* &= \left(\frac{S_k^{1-\beta} S_h^{\beta}}{n+g+\delta}\right)^{\frac{1}{1-\alpha-\beta}} \\ h^* &= \left(\frac{S_k^{\alpha} S_h^{1-\alpha}}{n+g+\delta}\right)^{\frac{1}{1-\alpha-\beta}}. \end{aligned} \tag{12}$$

The equilibrium level of real output per effective unit of labor is y^*:

$$y^* = S_k^{\frac{\alpha}{1-\alpha-\beta}} S_h^{\frac{\beta}{1-\alpha-\beta}} (n+g+\delta)^{-\frac{(\alpha+\beta)}{1-\alpha-\beta}}. \tag{13}$$

The output per effective unit of labor is a function of investment in physical and human capital, population growth, and technology. The natural logarithm of real output per capita (Y/L) is given by:

$$\ln\left(\frac{Y}{L}\right)_t = \ln Z_t + \left(\frac{\alpha}{1-\alpha-\beta}\right)\ln S_k + \left(\frac{\beta}{1-\alpha-\beta}\right)\ln S_h - \frac{(\alpha-\beta)}{1-\alpha-\beta}\ln(n+g+\delta), \tag{14}$$

where the level of technology is given by:

$$\ln Z_t = \ln Z_0 + g_t + \theta \ln R_t. \tag{15}$$

The empirical equation is:

$$\ln(Y/L)_t = constant + a_1 \ln S_k + a_2 \ln S_h + a_3 \ln(n+g+\delta) + a_4 \ln R_t. \quad (16)$$

Now let us assume that real output per capita grows at a speed λ to the steady-state. This gives:

$$\frac{d\ln(Y/L)}{dt} = \lambda\left(\ln\left(\frac{Y}{L}\right)^* - \ln\left(\frac{Y}{L}\right)\right) + g \quad (17)$$

where $(Y/L)^*$ is the equilibrium (steady-state) path of real output per capita defined above, and λ is the speed of convergence to the steady-state level of Y/L. One solution to this differential equation is:

$$\ln(Y/L)_t - \ln(Y/L)_{t-1} = (1-e^{-\lambda t})\frac{g}{\lambda} + (1-e^{-\lambda t})\left[\ln(Y/L)^* - \ln(Y/L)_{t-1}\right], \quad (18)$$

which describes the growth path of real output per capita between two points in time. This yields the following equation:

$$\Delta \ln(Y/L)_t = cons. + b_1 \ln S_k + b_2 \ln S_h + b_3 \ln(n+g+\delta) + b_4 \ln(Y/L)_0 + b_5 \Delta \ln R_t + e_t. \quad (19)$$

The change of the real exchange is an endogenous variable. Modeling the real exchange for SSA countries is a difficult matter, therefore, we will not do so. Instead, we will treat the depreciation term ΔR_t by decomposing the real exchange rate into the change of the real exchange rate measured at past prices and an inflationary part. The real exchange rate, R_t is defined as $(S.P^*/P)$[36]. Totally differentiating yields:

$$\Delta R_t = \frac{\Delta(SP^*)}{P_{t-1}} - \frac{\Delta P}{P_{t-1}} \cdot \frac{SP^*}{P_{t-1}}. \quad (20)$$

The first term is the change of real exchange rate at past prices, and the second term is inflation times the real exchange rate itself. Because we are measuring changes in the real exchange rate at past prices, we will assume that these changes are exogenous. Substituting equation (20) in equation (19) yields the following equation:

36/ The real exchange rate, R is defined as the ratio of the price of traded goods to the price of the non-traded goods. The spot exchange rate, S is defined as the domestic currency price of the U.S. dollar. P* is the price of traded goods approximated by the wholesale price index of the United States, WPI (1987=100). P is the domestic price of non-traded goods approximated by the GNP deflator (1987=100). Real exchange rate = ln $[(S.WPI_{USA})/GNP\ deflator_{(i)}]$ where i is a country index. The real devaluation variable is the first difference of the real exchange rate. R is Δ real exchange rate.

$$\Delta \ln (Y/L)_t = b_1 \ln S_k + b_2 \ln S_h + b_3 \ln (n+g+\delta) + b_4 \ln (Y/L)_0 + b_5 [\Delta \ln (\frac{SP^*}{P_{t-1}})] - b_6 [\pi . \ln (\frac{SP}{P_{t-1}})] + e_t. \quad (21)$$

The restrictions implied by the model are given by:

$$b_0 = (1-e^{-\lambda t}) \ln Z_0 + (1-e^{-\lambda t}) (t+\frac{1}{\lambda}) g > 0. \quad (22)$$

$$b_1 = (1-e^{-\lambda t}) \frac{\alpha}{1-\alpha-\beta} > 0. \quad (23)$$

$$b_2 = (1-e^{-\lambda t}) \frac{\beta}{1-\alpha-\beta} > 0. \quad (24)$$

$$b_3 = -(1-e^{-\lambda t}) \frac{(\alpha+\beta)}{1-\alpha-\beta} < 0. \quad (25)$$

$$b_4 = -(1-e^{-\lambda t}) < 0. \quad (26)$$

$$b_5 = (1-e^{-\lambda t}) \theta_1 > 0$$
$$b_6 = (1-e^{-\lambda t}) \theta_2 < 0, \quad (27)$$

The model implies that the growth rate of per capita real output depends positively on investment rates for physical and human capital, negatively on population growth, positively on changes in the real exchange rate at past prices and negatively on the inflation resulting from nominal devaluations.

Estimation and the Results.

We estimated equation (21) via 2SLS using pooled time-series and cross-section annual data for the period 1971-1991 for 22 SSA countries. We assumed that investment/GDP and human capital are endogenous

Table 8: 2SLS Instrumental Variables Results for the Augmented Mankiw, Romer and Weil Model with Pooled Time-Series and Cross-Section Data for 1971-1991.

	Unrestricted Model	Restricted Model	Unrestricted Model	Restricted Model
Independent Variables	Dependent Variable Rate of Growth of Real GDP per Capita			
$\ln Y_0$	0.0004	0.00003	-0.0006	0.00007
	(0.560)	(0.957)	(-0.659)	(0.088)
$\ln (I/GDP)_t$	0.024	0.024	0.026	0.016
	(3.729)*	(3.621)*	(2.885)*	(2.128)
$\ln$ (Life exp.)$_t$	0.015	0.010	0.028	0.007
	(3.061)*	(2.295)*	(2.569)*	(1.062)
$(n+g+\delta)$	-0.88	-0.034	-1.75	-0.024
	(-2.088)*	(-3.428)*	(-2.744)*	(-1.766)#
$\Delta\ln[(SP^*)/P_{t-1}]$	-	-	0.047	0.016
			(0.468)	(0.162)
π. $\ln[(SP^*)/P_{t-1}]$	-	-	-0.035	-0.027
			(-2.315)*	(-2.541)*
$\bar{R}^2$	0.0342	0.0329	0.0583	0.0402
F	4.508	4.454	3.805	3.097
P-value	0.0014	0.0043	0.0011	0.0094
N	396	396	375	375

An Asterisk denotes statistically significant at the 5 percent level. The symbol # denotes statistically significant at the ten percent level. Numbers in parentheses are t-ratios. Instrumental variables are lagged values and all other exogenous variables in the model.

variables.37/ We used population growth instead of the variable $(n+g+\delta)$ because we do not know the depreciation rates and the rate of growth of technological progress that satisfy the SSA countries38/. All regressions are corrected for hetroskedasticity by scaling all variables and the instruments by the estimated standard deviations of country specific residuals.39/ The results are reported in table 8.

The first regression is the growth model in the unrestricted form. All variables are found to be statistically significant at the 5 percent level and bear the expected signs except for initial income (1971 income measured in U.S. dollar). This estimated coefficient is found to be statistically not different from zero at the 5 percent level.40/

The second regression is the basic Mankiw, Romer and Weil model with the restrictions that $b_1+b_2+b_3=0$ imposed. We tested the restriction and found it to hold on the 10 percent level only.

The third regression is the unrestricted augmented growth model. Again, most variables are found to be statistically significantly different from zero at the 5 percent level. Initial income is found to be insignificant at the 5 percent level. The estimated coefficient on $\Delta\ln[(SP^*)/P_{t-1}]$ is found to be positive but statistically insignificant. The term that includes the domestic inflation rates $[\pi.\ \ln\ (SP^*/P_{t-1})]$ is found to be negative as expected and statistically significant. This is interpreted as a negative effect of inflation on per capita real GDP growth in the transition to the steady-state (Fischer, 1993). We tested the restriction $b_5+b_6=0$ and found it to hold at the 5 percent level. Thus, when we control for effect of inflation, real depreciations have neutral effect on real per capita growth rates in the transitional period. Note that the fiscal

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37/ We measure human capital by the variable life expectancy at birth. This measurement is not the best measurement but we use it because data are readily available in World Tables. A better measurement can be life expectancy for population 16-55 years of age. This latter variable is not available. For example, Barro and Lee (1993) use enrollment ratios at the primary and secondary school levels to measure human capital. Life expectancy at birth is usually assumed to be an endogenous variable and a function of education and health. We cannot find complete time series for 1971-1991 for these two variables. The instruments used in the regressions are simply lagged values.

38/ The term $(n+g+\delta)$ is traditionally treated in the literature by assuming some values for g and δ such that $(n+g+\delta)$ is equal to $\ln\ (n+.05)$.

39/ Two tests for homoskedasticity are used. The Breush-Pagan test and the White test.

40/ We do not test for convergence. We follow Friedman (1992) argument that testing for convergence in growth model is in fact a regression fallacy.

and monetary policies variables are not controlled for by the model. This makes it very difficult to isolate the effects of real depreciations on the growth rate of per capita income.

The fourth regression is the restricted augmented growth model. The restriction are found to be statistically insignificant at the 5 percent level. However, we cannot reject the restriction that $b_5+b_6=0$. We estimate the implied shares of physical and human capital α and ß in the restricted regressions (the second and the fourth) to be 0.023, and 0.0096 and 0.015 and 0.0068 respectively. These estimates suggest that there are variables other than physical and human capital that could be important in determining the growth rate in SSA.41/

C. Inflation, Money Growth, Output Growth, and Devaluations: A Causality Test

The Granger-Causality Model

The relationship between inflation, money growth, and income can be derived from the following exchange equation:

$$P+Y\equiv M+V, \tag{28}$$

where P is the natural logarithm of the price level, Y is the natural logarithm of real output, M is the natural logarithm of money stock, and V is the natural logarithm of the velocity of money. This identity can be rearranged such that

$$\Delta P_t = \alpha_1 \Delta M_t - \alpha_2 \Delta Y_t + \alpha_3 \Delta i_t, \tag{29}$$

which is an inflation equation, where money growth is positively correlated with inflation, income growth is countercyclical for a given rate of money growth, and the interest rate is positively

41/ We also estimated a regression equation with additional lagged changes of real exchange rates. We tested the restriction that the sum of the lagged terms is equal to zero. We cannot reject the restriction that all lagged changes of the real exchange rate sum to zero at the 5 percent level. Therefore, real depreciations have neutral effect on growth. The estimated coefficients are not reported.

correlated with inflation. The coefficients α_1, α_2, and α_3 can be estimated and the hypothesis that these coefficients are significantly not different from one can be tested empirically.42/

Instead of estimating the model above, we will focus on the causal relationships between these variables and nominal devaluations. The idea is to determine the direction of causality and what are the policy implications of such findings. For example, if money growth causes inflation then the policy lesson is clear; a tighter monetary policy may be required. The interesting question is about the causality direction between devaluations-inflation and devaluations-money growth.

The analysis is based on Granger's (1969) causal model and Alvi and Islam (1989) who implement the test for time series-cross sectional data.

$$
\begin{aligned}
\Delta P_t &= \alpha_0 + \sum_{i=1}^{k} a_i \Delta P_{t-i} + \sum_{i=1}^{k} b_i \Delta M_{t-1} + \sum_{i=1}^{k} c_i \Delta Y_{t-i} + \sum_{i=1}^{k} d_i \Delta N_{DEV_{t-i}} + e_{1t}, \\
\Delta M_t &= \beta_0 + \sum_{i=1}^{k} e_i \Delta M_{t-i} + \sum_{i=1}^{k} f_i \Delta P_{t-1} + \sum_{i=1}^{k} g_i \Delta Y_{t-i} + \sum_{i=1}^{k} h_i \Delta N_{DEV_{t-i}} + e_{2t}, \\
\Delta Y_t &= \delta_0 + \sum_{i=1}^{k} i_i \Delta Y_{t-i} + \sum_{i=1}^{k} j_i \Delta P_{t-i} + \sum_{i=1}^{k} l_i \Delta M_{t-i} + \sum_{i=1}^{k} m_i \Delta N_{DEV_{t-i}} + e_{3t}, \\
\Delta N_{DEV_t} &= \gamma_0 + \sum_{i=1}^{k} n_i \Delta N_{DEV_{t-i}} + \sum_{i=1}^{k} o_i \Delta P_{t-i} + \sum_{i=1}^{k} p_i \Delta M_{t-i} + \sum_{i=1}^{k} q_i \Delta Y_{t-i} + e_{4t},
\end{aligned}
\tag{30}
$$

where all variables are in natural logarithms, therefore, rate of growth of prices (inflation), rate of growth of money stock, rate of growth of output, and rate of growth of nominal exchange rate (devaluations), which is defined as the percentage change of the nominal exchange rate. All variables in the system are stationary time series. The error terms are uncorrelated. The idea is to conduct a series of F tests on all the coefficients in the Vector Auto-Regressive (VAR) system to test the null hypotheses that the sum of each of the coefficients is equal to zero. For example, if the sum of the coefficients b_i is statistically different from zero, then we say money growth Granger-causes inflation. It is important to carefully determine the number of lags, k.43/ The number of lags here is set equal to four.

42/ The other model for inflation is the structurlist model. This model emerged in Latin America in the 1950s as an alternative to the monetary model above. The model emphasizes bottlenecks that accompany development processes as determinants of inflation. Thus, inflation is a function of sectoral impasses or constraints.

43/ We use the Akaike (1974) Information Criterion (AIC) and Hall's (1992) general-to-specific method to determine the optimal lag length. We fit a general lag structure (4 lags) and use an F-test to test backward and eliminate all unnecessary lags.

Estimation and Results

The results are reported in table 9. We find a statistically significant causal relationships between money growth and inflation that run in both directions. Thus, Money growth Granger-causes inflation and inflation Granger-causes money growth. This result needs no further explanations. We also find that output growth Granger-causes inflation and that inflation Granger-causes devaluations. No causality is detected between money growth and real output, money growth and devaluations, and output and devaluations.

D. Real Exports Growth, Output Growth, and Real Devaluations: A Causality Test

The objective of this section is to examine the causal relationship between real exports and real devaluations in Sub-Saharan Africa. Real devaluations are defined here as the percentage changes of the real exchange rate that are equal to or greater than 15 percent. This cutoff point was used by Edwards.44/ We apply the Granger-Causality (1969) test to pooled time-series and cross-section data for 19 Sub-Saharan African countries45/ for the period 1971-1991. Among these countries, there are 13 that have gone through major devaluation episodes during the 1980s as defined above.46/

44/ We have also tested the model without any cutoff point and found similar results.

45/ The countries are chosen because we have complete time-series for all variables. These countries are Benin, Cote d'Ivoire, Cameroon, Congo, Gabon, Ghana, Gambia, Kenya, Madagascar, Mali, Mauritania, Mauritius, Malawi, Niger, Nigeria, Senegal, Togo, Zaire, and Zambia.

46/ Countries that implemented devaluation policies are Botswana, Ghana, Gambia, Kenya, Lesotho, Madagascar, Mauritania, Mauritius, Malawi, Nigeria, Rwanda, Zaire, and Zambia.

Table 9. Summary of Causal inferences for Twenty SSA countries, 1971-1991.

Null Hypothesis	Devaluation=N_DEV	Causal inference
1. ΔM does not cause ΔP	F=7.2073 (0.0077)*	Inflation → Money Growth
2. ΔP does not cause ΔM	F=21.1425 (0.0001)*	Money Growth → Inflation
3.ΔY does not cause ΔP	F=8.2025 (0.0045)*	Income Growth → Inflation
4.ΔP does not cause ΔY	F=0.7295 (0.3937)	No causality
5.Devaluation does not cause ΔP	F=0.4888 (0.4850)	No causality
6.ΔP does not cause devaluations	F=16.3632 (0.0001)*	Inflation → Devaluation
7.ΔM does not cause ΔY	F=1.0408 (0.3084)	No causality
8.ΔY does not cause ΔM	F=0.0400 (0.8416)	No causality
9.ΔY does not cause devaluations	F=2.6637 (0.1037)	No causality
10.Devaluation does not cause ΔY	F=0.0031 (0.9557)	No causality
11.ΔM does not cause devaluations	F=0.1293 (0.7195)	No causality
12.Devaluation does not cause ΔM	F=0.2077 (0.6489)	No causality

* Statistically significant at the 5% level.
# Statistically significant at the 10% level.
P-values in parentheses.
Number of observations is 302. All variables are in natural logarithms; so Δln is the rate of growth.

Methodology and the data

Nelson and Schwert (1982), and Geweke, Meese and Dent (1983) argue that the OLS version of the Granger test is more powerful than most of the other procedures, for example, Sims (1972).

The Granger procedure can be described by the following system,

$$\Delta X_t = a_0 + \sum_{i=1}^{k} a_i \Delta X_{t-i} + \sum_{i=1}^{k} b_i \Delta R_{t-i} + \sum_{i=1}^{k} c_i \Delta P_{t-i} + e_t, \qquad (31)$$

$$\Delta R_t = d_0 + \sum_{i=1}^{k} f_i \Delta R_{t-i} + \sum_{i=1}^{k} g_i \Delta X_{t-i} + \sum_{i=1}^{k} h_i \Delta P_{t-i} + v_t, \qquad (32)$$

$$\Delta P_t = i_0 + \sum_{i=1}^{k} j_i \Delta P_{t-i} + \sum_{i=1}^{k} l_i \Delta X_{t-i} + \sum_{i=1}^{k} m_i \Delta R_{t-i} + u_t, \qquad (33)$$

Where, X is the real export growth defined as the first difference of the natural logarithm of the real exports measured in domestic currency. Inflation, P is defined as the first difference of the natural logarithm of the GNP deflator. R is the real exhange rate which is the ratio of traded goods price level to non-traded goods price level. This variable is measured by $S.P^*/P$ as defined earlier. And ΔX_t, ΔR_t, and ΔP_t are stationary time series and e_t, v_t, and u_t are uncorrelated error terms that retain the classical regression assumptions. Unidirectional causality from ΔR to ΔX or from ΔX to ΔR requires that at least some b_i's and g_i's to be significantly different from zero. The same condition is required for causality from ΔP to ΔX (some c_i's $\neq 0$) or from ΔX to ΔP (some l_i's $\neq 0$), from ΔP to ΔR (some h_i's $\neq 0$) and from ΔR to ΔP (some m_i's $\neq 0$). Bidirectional causality in the order above implies that $b_i \neq 0$, $g_i \neq 0$, $c_i \neq 0$, $l_i \neq 0$, $h_i \neq 0$, and $m_i \neq 0$ for at least some i's. Of course, if ΔR, ΔX, and ΔP are causally independent, all the coefficients of ΔR in equations (31) and (33) and of ΔX in equations (32) and (33) and of ΔP in equations (31) and (32) should be statistically insignificant.

The time series X, R, and P are nonstationary. These series are tested by the Augmented Dickey-Fuller test (1984).47/ All series are first differenced and checked for unit

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47/ Test statistics are not reported. For all variables, we tested the null hypothesis that $\rho=0$ in the following regression equation:
$\Delta R_t = \beta_0 + \rho R_{t-1} + \Sigma_{i=1}\alpha_i \Delta R_{t-i} + \mu_t$. R is X, R, and P respectively. Critical values are in Dickey-Fuller (1979).

root again. The optimal number of lags, k in equations (31), (32), and (33) is determined by two methods: the Akaike (1974) Information Criterion (AIC) and by fitting a general lag structure and test backward using F-test.48/ The standard F-Statistics are used to test the joint significance of the corresponding lag coefficients.

The exports supply relationship captures the relationships between real exports, the real price of exportable goods measured by the real exchange rate, and the cost of production at the home country measured by the home inflation rates. All regressions are corrected for hetroskedasticity using the estimated standard deviations for each country to scale the variables in the regressions including the constants.

Empirical Results

We test the following six hypotheses:

- real devaluations (ΔR) does not Granger-Causes real export Growth (ΔX);
- real export Growth (ΔX) does not Granger-Causes real devaluations (ΔR);
- inflation (ΔP) does not Granger-Causes real export growth (ΔX);
- real export (ΔX) does not Granger-Causes Inflation (ΔP);
- real devaluations (ΔR) does not Granger-Causes inflation (ΔP); and
- inflation (ΔP) does not Granger-Causes real devaluations (ΔR).

Table 10 presents summary results of the above causality tests. Estimates of F-statistics and their P-values are reported in column 2. A causal inference is reported in column 3 where an arrow indicates the direction of significant causality. On the basis of these statistics, it is clear that there is no support for any causal link between real export growth and real devaluations. Statistical inferences indicate that real devaluations do not cause real exports growth. The absence of any significant causal relationships between real devaluations and real exports growth can be due to the omission of an independent factor that jointly influences real exports growth and real devaluations.

48/ Sephton (1989) suggests that inappropriate lag structure could result in misleading causal relationship. The General-to-Specific method is described in Hall (1992).

Table 10. Summary of Causal inferences for 19 SSA countries, 1971-1991.
Real devaluations = %Δ Real exchange rate Greater than 15%

Null Hypothesis	(1)	(2) Causal inference
1. Real Devaluation does not cause Real export Growth	F=0.7540 (0.3861)	No Causality
2. Real Export Growth does not cause Real evaluations	F=0.3795 (0.5384)	No Causality
3. Inflation does not cause Real Export Growth	F=0.5373 (0.4643)	No Causality
4. Real Export Growth does not cause Inflation	F=0.0217 (0.8831)	No Causality
5. Real Devaluation does not cause Inflation	F=2.3995 (0.1227)	No Causality
6. Inflation does not cause Real Devaluations	F=1.0202 (0.3135)	No Causality

P-values in parentheses.
Number of observations is 286.

E. Conclusions

Pooled time-series and cross-section data for 22 African countries covering the period 1971-1991 are used to test a number of hypotheses.

First, we find that nominal devaluations have a long-run impact on real devaluations; that nominal devaluations have significant contemporaneous relationship with real exchange rate devaluations; and that there is a significant long-run relationship between the two forms of devaluations. A 10 percent nominal devaluation at time t gives a 7.7 percent real depreciation in the long run. We also show that expansionary monetary policy leads to appreciation of the real exchange rate for this group of SSA countries. The data confirm that devaluations can indeed be an effective policy tool to correct an overvalued currency if accompanied by restrictive monetary and fiscal policies.

Second, the same data are used to estimate an augmented Mankiw, Romer and Weil model. We augmented the model with real exchange rate depreciations as factor affecting total output productivity. We find that depreciations have neutral effect on real output per capita growth rate in the transition to steady-state.

Third, we investigated the causal relationship between, inflation, money growth, output growth, and devaluations. We find that money growth and real output growth cause inflation; that inflation causes money growth and devaluations; and that there is no significant causal relationship that runs from real exchange rate depreciations to real export growth.

The above results, particularly the effects of real exchange rate depreciations on growth and exports, should be interpreted with caution as fiscal policies are not controlled for in the models.

Appendix 1

The following is a list of variables used in equations (6), (21), (30) and (31) which are tested in this paper:

g :Growth rate of technology

INFTAX :Inflation tax defined as inflation times real money balances$(M/P)_t$.

I :Real investment.

Life :Life expectancy at birth.

L :Labor

M :Money stock.

NDEV :Nominal devaluation defined as the percentage change in the nominal exchange rate.

n :Population growth rate

P :The price of non-traded goods measured by the GDP deflator. In equations (31) to (33), P represents rate of inflation which is computed by $\Delta \ln P_t$

P* :The price of traded goods measured by the wholesale price index (the US price index is used as a proxy).

R: Real Exchange Rate (RER) defined as the ratio of the price of traded goods to the price of the non traded goods. The U.S. wholesale price index is used as a proxy for the price of traded goods. The price of the non traded goods is the GDP deflator defined above. In equations (31) to (33), R represents the rate of RER depreciation.

r :Change in expected cost of holding domestic money as a proxy for interest rate is defined as the Δ (inflation_{t-1} - inflation_{t-2}), where inflation is $\Delta \ln P_t$.

Sk :The fraction of real income spent on physical capital

Sh :The fraction of real income spent on human capital

S :Nominal exchange rate defined as the home currency price of the $ U.S.

X :Real export growth rate.

Y :Real GDP. In equations (31) to (33), Y represents GDP growth rate.

Data source: International Financial Statistics and World Tables (various issues).

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ANNEX TABLES

Table A1: Evidence on African Smallholder Supply Elasticities

Product and Country	*Period*	*Short-run Elasticity*	*Long-run Elasticity*	*Author*
Cocoa:				
Ghana	1930-1940		0.43	Ady, 1949
	1920-1939	0.17		Stern, 1965
	1920-1946	0.15		Ibid.
	1946-1962		0.32-0.87	Behrman, 1968
	1946-1962		0.77-1.28	Ibid.
	1947-1964		0.71	Behrman, 1968
Nigeria	1920-1945		1.29	Stern, 1965
	1947-1964		0.45	Behrman, 1968
	1948-1967		0.20	Olayide, 1972
Ivory Coast	1947-1964		0.80	Behrman, 1968
Cameroon	1947-1964		1.81	Ibid.
Coffee:				
Kenya: Estates Acreage	1946-1964	0.16	0.47	Maitha, 1969; Ford, 1971
Kenya: Smallholder Acreage	1946-1964	0.20	0.56	Ibid.
Kenya: Estates Yield	1946-1964	0.66	1.71	Maitha, 1970; Ford, 1971
Kenya: Smallholder Yield	1946-1964	0.64	1.01	Ibid.
Palm Oil:				
Nigeria	1950-1964	0.81		Diejomaoh, 1972
	1949-1963	0.41		Helleiner, 1966
	1948-1967		0.22-0.26	Olayide, 1972
Eastern Nigeria	1949-1966	0.41-0.70		Oni, 1969a
Palm Kernels:				
Nigeria	1950-1964	0.25		Diejomaoh, 1972
Cotton:				
Nigeria	1950-1964	0.67		Diejomaoh, 1972
	1948-1967	0.21-0.38		Oni, 1969b
	1948-1967	0.3		Olayide, 1972

Product and Country	*Period*	*Short-run Elasticity*	*Long-run Elasticity*	*Author*
Tanzania	1953-1969		2.44	Mulima, 1971
Tobacco:				
Malawi	1926-1960	0.48		Dean, 1966
Rubber:				
Nigeria	1948-1967	0.21	0.17-0.24	Olayide, 1972
Haricot Beans:				
Ethiopia	1953-1970	1.60		Goering et al.
Civet: Ethiopia	1957-1970	3.16		Ibid.
Pulses: Ethiopia	1952-1970	0.72		Ibid
Lentils: Ethiopia	1953-1970	1.30		Ibid
Sesame:				
Ethiopia	1957-1970	0.61		Ibid

Source: Oyejide(1990)

Table A2: Ten Sub-Saharan African Countries: Cash-crop Supply Elasticities

Crop Region	*Period*	*Author*	*Year*	*Short-run elasticity (first year)*	*Long-run elasticity*
Cocoa:					
Ghana	1947-1964	Behrman	(1968)		0.71*
Ghana (old areas)	1949-1962	Bateman	(1965)	0.39	0.77
Ghana (medium areas)	1949-1962	Bateman	(1965)	0.42-0.51	1.28
Ghana (new areas)	1949-1962	Bateman	(1965)	0.61-0.87	1.06
Nigeria	1947-1964	Behrman	(1968)		0.71*
Nigeria	1947-1964	Behrman	(1968)		0.45*
Ivory Coast	1947-1964	Behrman	(1968)		0.80*
Cameroon	1947-1964	Behram	(1968)	0.68*	1.81*
Coffee:					
Kenya	1946-1964	Maitha	(1970)	0.64*	1.33*
Kenya (Estate)	1946-1964	Maitha	(1970)	0.66*	1.38*
Kenya (Smallholders)	1946-1964	Maitha	(1970)	0.64*	1.48*
Kenya	1946-1964	Ford	(1971)		1.07*
Kenya (Estates)	1946-1964	Ford	(1971)		1.18*
Kenya (Smallholders)	1946-1964	Ford	(1971)	1.55*	
Africa	1947-1973	de Vries	(1975)	0.12*	0.44*
Cotton:					
Nigeria	1948-1967	Oni	(1969b)	0.23-0.38	0.28
Nigeria	1950-1964	Diejomaoh	(1973)	0.67*	0.67*
Sudan	1951-1965	Medani	(1970)	0.39*	0.50*
Uganda	1922-1938	Frederick	(1969)	0.25*	0.25*

Crop Region	*Period*	*Author*	*Year*	*Short-run elasticity (first year)*	*Long-run elasticity*
Uganda Buganda	1922-1938	Frederick	(1969)	0.67*-0.73*	0.67*-0.73**
Uganda Buganda	1945-1966	Alibaruho	(1974)	0.50	0.63
Uganda (Eastern Region)	1945-1966	Alibaruho	(1974)	0.23	0.44
Uganda (Western Region)	1945-1966	Alibaruho	(1974)	0.26	0.62
Uganda (Northern Region)	1945-1966	Alibaruho	(1974)	0.02	0.07
Groundnuts:					
Nigeria	1948-1967	Olayide	(1972)	0.24-0.79	0.24-0.79
Palm Kernels:					
Nigeria	1949-1964	Oni	(1969a)	0.22-0.28	0.22-0.28
Nigeria (Eastern)	1949-1964	Oni	(1969a)	0.28-0.39	0.28-0.39
Nigeria	1950-1964	Diejomaoh	(1973)	0.25*	0.25*
Palm Oil:					
Nigeria	1950-1964	Diejomaoh	(1973)	0.81*	0.81*
Nigeria	1949-1963	Helleiner	(1966)	0.41*	0.41*
Nigeria	1949-1964	Oni	(1969a)	0.29-0.35	0.29-0.35
Nigeria (Eastern)	1949-1964	Oni	(1969a)	0.41*-0.70*	0.41-70*
Rubber:					
Liberia	1950-1972	Ghoshal	(1974)	0.14	0.22
Nigeria	1952-1972	Olayemi and Olayide	(1975)	0.04	1.75*

Crop Region	*Period*	*Author*	*Year*	*Short-run elasticity (first year)*	*Long-run elasticity*
Sisal:					
Tanzania	1945-1967	Gwyer	(1971)	0.06*	0.48*-0.76*
Tobacco:					
Malawi	1926-1960	Dean	(1966)	0.48*	0.48*
Nigeria	1945-1964	Adesimi	(1970)	0.60*	0.82*

Notes:
An asterisk indicates that the estimate is significantly different from zero at the 5 percent level of significance. In these equations, acreage rather than quantity produced was used as the dependent variable.

References For Annex Tables 1 and 2:

Stern, R. M. "The Determinants of Cocoa Supply in West Africa," in Africa Primary Products and International Trade, ed. I.G. Steward and H.W. Ord (Edinburgh: Edinburgh University Press, 1965); Merril J. Bateman, "Aggregate and Regional Supply Functions for Ghanaian Cocoa, 1946-1962," Journal of Farm Economics 47, No. 2 (1965): 384-401; S. Olajuwon Olayide, "Some Estimates of Supply Elasticities of Nigeria's Cash Crops," Journal of Agricultural Economics 23, No. 3 (1972); J.K. Maitha, "Productivity Response to Price: A Case Study of Kenyan Coffee," Eastern Africa Economic Review 2, No. 2 (1970); Derek J. Ford, "Long-Run Price Elasticities in the Supply of Kenyan Coffee: A Methodological Note," Eastern Africa Economic Review, n.s. 3, No. 1 (1971); T. James Goering, Akilu Afework and Abate Temesgen, "The Response of Ethiopian Farmers to Changes in Product Prices," Forthcoming; Victor P. Diejomaoh, "Rural Development in Nigeria: The Role of Fiscal Policy" (Paper presented to the Annual Conference of the Nigerian Economic Society, March 1972); Gerald K. Helleiner, Peasant Agriculture, Government, and Economic Growth in Nigeria (Homewood, III: Irwin, 1966); S.A. Oni, "Production Response in Nigerian Agriculture: A Case Study of Palm Produce, 1949-1966," Nigerian Journal of Economic and Social Studies 11, No. 1 (1969a); S.A. Oni, "Econometric Analysis of Supply Response among Nigerian Cotton Growers," Bulletin of Rural Economics and Sociology 4, No. 2 (1969b); Edwin Dean, The Supply Responses of African Farmers: Theory and Measurement in Lamawi (Amsterdam: North Holland, 1966); Jere R. Behrman, "Monopolistic Cocoa Pricing," American Journal of Agricultural Economics 58 (1968); Kighoma A. Malima, "The Determinants of Cotton Supply in Tanzania," Economic Research Bureau Paper 71.4 (Dar es Salaam: University of Dar es Salaam, 1971).

Source: Bond, 1983.

Table A3: Estimates of Aggregate Supply Response in Agriculture: Sub-Saharan Africa

	Bond (1983)		Berthelemy and Morrison (1989)	
		Short-run Long-run		
Country	*Period*	*Estimate*	*Period*	*Estimate*
Ghana	1963-81	0.20 - 0.34*	1963-85	0.76*
Kenya	1963-81	0.10 - 0.16*	1961-85	0.2
Cote d'Ivoire	1963-81	0.13 - 0.13	1962-86	0.6
Liberia	1963-81	0.10 - 0.11		
Madagascar	1963-81	0.10 - 0.14	1963-85	0.09 - 0.17
Senegal	1963-81	0.54 - 0.54	1962-84	0.7 - 1.0*
Tanzania	1963-81	0.15 - 0.15		
Uganda	1963-81	0.05 - 0.07		
Burkina Faso	1963-81	0.22 - 0.24		
Cameroon			1962-85	0.05 - 0.2
Cameroon			1975-85	0.8
Mali			1963-85	0.5 - 0.6*

Note: * Statistically significant at 10 percent level of significance.

Source: Chhibber(1991).

Table A4: Export Concentration and Export Share of Manufactures and Fruits and Vegetables in SSA, 1987-88 (in percent)

Country	Year	Export Share of Manufactures a/	Export Share of Fruits and Vegetables b/	Share of Principal Export	Share of Top Two Exports
Benin	1988	--	--	47.8	82.6
Botswana	1988	--	--	76.7	81.3
Burkina Faso	1988	--	--	27.6	50.7
Burundi	1988	6.8	--	82.9	89.7
Cameroon	1987/88	--	--	45.7	59.8
Cape Verde	1988	--	24.2	27.7	51.8
Cent. Afr.Rep.	1988	--	--	39.5	55.6
Chad	1988	--	--	48.3	48.3
Comoros	1988	--	--	85.1	85.1
Congo	1988	--	--	79.2	92.2
Cote d'Ivoire	1988	--	2.3	15.2	46.9
Equat. Guinea	1988	--	--	54.5	92.7
Ethiopia	1988	--	1.2	57.8	72.3
Gabon	1988	--	--	62.0	75.5
Gambia	1987/88	-		78.8	88.9
Ghana	1988	--	--	52.5	71.6
Guinea	1988	--	--	82.1	82.3
Guinea-Bissau	1988	--	--	83.0	90.9
Kenya	1988	--	13.5	4.8	45.6
Lesotho	1988	64.0	--	64.0	81.0
Liberia	1988	--	--	47.4	71.6
Madagascar	1988	--	--	6.7	51.6
Malawi	1988	--	1.1	63.5	73.9
Mali	1988	--	--	41.8	71.3
Mauritania	1988	--	--	65.9	99.0
Mauritius	1988	61.9	--	61.9	96.3
Mozambique	1988	--	1.8	42.8	68.5
Niger	1988	--	--	73.7	84.6
Nigeria	1988	--	--	85.5	89.2
Rwanda	1988	--	--	1.0	96.1
Sao Tome	1988	9.1	--	88.2	90.7
Senegal	1988	--	--	24.6	41.2
Seychelles	1988	--	--	80.3	89.3
Sierra Leone	1987/88	-		32.3	50.1
Somalia	1988	--	40.4	0.4	78.9
Sudan	1988	--	--	33.2	47.4
Swaziland	1988	5.2	27.4	.9	58.3
Tanzania	1988	19.5	--	25.9	46.1
Togo	1988	--	--	49.7	66.8
Uganda	1987/88	-		86.0	97.7
Zaire	1988	--	--	55.3	67.8
Zambia	1988	--	--	83.9	90.5
Zimbabwe	1988	20.8	--	20.8	31.1

a/ Excludes cotton lint and fabrics.
b/ Includes bananas (Cape Verde and Somalia).

Table A5: Major Depreciations in SSA Countries (1980-92)

Angola a/		Botswana		Burundi		Cape Verde	
Date	Deprec.	Date	Deprec.	Date	Deprec.	Date	Deprec.
91.3	100%	82.5	12%	83.11	29%	80.6	10%
		84.7	13%	86.7	15%	82.6	9%
Data available		85.1	14%	88.2	10%	91.3	6%
till 91.6		85.7	12%	89.11	13%		
		85.8	13%	91.8	18%		
		86.6	13%	92.6b/	10%		

The Gambia i/		Ghana a/		Guinea i/		Guinea-Bissau i/	
Date	Deprec.	Date	Deprec.	Date	Deprec.	Date	Deprec.
81.2	6.42%	83.10	991%	86.1	1250%	83.12	100%
81.6	4.74%	84.3	17%	86.5	16%	87.5	145%
84.2	20.70%	84.8	10%	86.9	5%	87.12	15%
86.1	54.10%	84.12	30%	87.1	80%	88.1	10%
c/		85.4	1%	87.4	5%	88.8	15%
87.3	6.30%	85.8	8%	87.8	3%	88.9	13%
89.9	6.55%	85.10	5%	88.7	3%	89.2	11%
91.3	5.12%	86.1	50%	88.10	8%	89.3	90%
		87.2	67%	88.12	6%	89.6	8%
		87.8	93%	89.9	5%	89.11	7%
		87.9	7%	91.7	7%	90.7	9%
		88.2	3%	fixed to US$ till 85.12		91.1	9%
		88.7	6%			91.3	9%
		88.8	14%			91.8	16%
		89.2	12%				
		92.3	4%				
		fixed to US$ till end 87					

Kenya		Lesotho		Madagascar		Malawi	
Date	Deprec.	Date	Deprec.	Date	Deprec.	Date	Deprec.
81.2	6%	81.7	6%	CFA			
				till 82.3			
81.9	18%	82.3	6%			82.4	15%
82.12	18%	83.10	7%	82.5	14%	83.9	12%
83.7	3%	84.7	20%	83.1	7%	84.1	4%
84.5	3%	84.10	13%	83.9	10%	85.4	17%
84.11	3%	85.7	15%	84.3	15%	85.8	4%
85.3	5%	85.8	27%	86.8	24%	86.2	7%
85.8	10%	86.5	11%	87.2	6%	86.8	11%
86.2	5%	86.6	3%	87.6	63%	87.2	25%
86.6	3%	88.2	5%	91.1	13%	88.1	17%
87.1	7%					90.3	9%
87.1	4%					92.3	18%
89.9	5%					pegged to SDR till 84.1	
pegged to SDR till 86.12							

Mauritania i/		Mauritius		Mozambique		Nigeria	
Date	Deprec.	Date	Deprec.	Date	Deprec.	Date	Deprec.
80.4	34%	81.9	20%	82.6	4%	80.4	3%
84.2	30%	91.3	4%	87.1	413%	81.2	4%
84.3	3%	fixed to SDR till 83.3		87.7	100%	81.6	5%
84.4	3%			88.1	12%	83.6	4%
84.5	3%			88.7	29%	85.3	5%
85.1	7%			88.10	7%	85.9	5%
85.2	11%			89.1	4%	85.12	8%
85.9	4%			89.9	6%	86.6	15%
89.4	5%			89.12	15%	86.7	14%
				90.3	5%	86.9	21%
				90.9	8%	86.10	136%
				90.12	7%	87.1	22%
				91.4	25%	87.8	8%
				91.9	14%	87.10	5%
				91.10	5%	88.7	9%
				92.3	9%	88.10	7%
				92.4	9%	88.11	13%
						89.1	32%
						89.2	6%
						90.11	7%
						91.1	5%
						91.7	12%
						92.2	7%
						92.3	74%

Rwanda a/		Sao Tome		Sudan a/		Swaziland	
Date	Deprec.	Date	Deprec.	Date	Deprec.	Date	Deprec.
83.9	5%	87.7	124%	81.11	80%	81.7	6%
86.5	2%	88.7	26%	82.11	44%	82.3	6%
87.2	1%	89.2	19%	85.2	92%	83.1	6%
87.5	13%	89.10	8%	87.10	80%	84.7	19%
88.1	3%	89.11	10%			84.10	12%
88.6	5%	90.5	8%			84.12	6%
89.5	5%	91.5	19%			35.7	15%
90.11	66%	91.9	48%			85.9	18%
92.6	14%					85.11	7%
						86.5	11%

Sierra Leone a/i/		Somalia a/i/		Tanzania		Uganda	
Date	Deprec.	Date	Deprec.	Date	Deprec.	Date	Deprec.
83.7	94%	82.7	142%	82.3	11%	81.6	826%
85.2	135%	83.7	3%	83.6	26%	81.12	5%
86.6	147%	83.10	11%	84.6	35%	82.5	5%
86.7	88%	84.9	48%	86.4	28%	82.6	4%
86.8	14%	85.1	38%	86.5	27%	82.12	6%
86.9	13%	85.5	7%	86.6	60%	83.4	6%
88.3	24%	86.1	28%	f/		83.5	6%
88.43							
87.2	13%	e/		87.10	8%	83.6	13%
87.3	20%	87.6	47%	87.11	9%	g/	19%
88.3	24%	88.6	80%	87.12	13%	83.11	13%
88.6	6%	88.8	23%	88.11	25%	84.2	15%
88.8	11%	89.2	13%	89.6	6%	84.8	24%
88.10	21%	89.3	10%	89.12	27%	84.1	10%
89.1	10%	89.5	29%	91.5	9%	84.11	17%
89.4	49%	89.6	10%	92.3	17%	85.1	48%
90.1	86%	89.8	11%	92.7	9%	85.11	41%
90.5	35%	89.11	10%			85.12	322%
90.9	8%	89.12	37%			87.5	147%
91.7	23%	90.1	9%			88.7	19%
91.9	17%	90.2	8%			89.3	70%
91.10	12%		data till			89.1	10%
			90.5			89.11	16%
						90.6	16%
						91.7	16%
						92.3	15%

Zaire i/		Zambia		Zimbabwe	
Date	Deprec.	Date	Deprec.	Date	Deprec.
80.2	42%	83.1	25%	82.12	23%
81.6	67%	83.8	7%	84.7	8%
83.9	355%	83.12	7%	84.1	5%
83.10	7%	84.1	7%	85.8	11%
84.1	5%	85.2	6%	88.10	5%
84.2	6%	85.1	219%	91.7	861%
84.3	7%	86.1	14%	91.8	13%
85.1	6%	86.2	10%	91.9	31%
85.3	7%	86.6	7%	Fixed to US$ till 83.06	
86.7	7%	86.9	14%		
87.1	19%	86.1	42%		
87.2	8%	86.11	45%		
87.3	12%	87.4	145%		
87.4	14%	88.11	24%		
87.11	7%	89.7	50%		
88.3	15%	89.1	10%		
88.1	15%	89.12	16%		
88.12	15%	90.1	10%		
89.1	10%	90.6	10%		
89.7	6%	90.7	9%		
89.8	127%	91.2	10%		
h/		92.2	29%		
91.8	127%	92.6	11%		
91.9	18%				
91.10	39%				
91.11	148%				
92.1	41%				
92.3	41%				
92.5	39%				
92.6	105%				
92.7	72%				

Depreciation = (exchange rate(t)/exchange rate(t-1))-1.

N.A. = Not Available.

The exchange rate is defined as local currency per SDR (official rate - end of the period).

a/ Countries in which the exchange rate is defined as Local Currency per US$ (end of the period)

b/ From 88.05 to 88.08 crawling peg (2.5% average)

c/ From 86.02 to 86.05 crawling peg (20%, 9%, 7% and 3% depreciation)

d/ No devaluations, one revaluation in 1981.3 (13%)

e/ From 86.03 to 86.11 crawling peg (6% average)

f/ From 86.07 to 87.4 crawling peg (5% average)

g/ From 83.07 to 83.10 crawling peg (6% average)

h/ From 90.07 to 91.07 crawling peg (24% average)

i/ Market rate end of the period

Source: The World Bank BESD data bank.

Table A6: Real Effective Exchange Rate in SSA [1/]

Country	1980	1985	1990	1991
Angola	100	...	...	...
Benin	100	80.99	81.65	81.05
Botswana	100	89.39	90.12	86.39
Burkina Faso	100	83.52	75.04	73.11
Burundi	100	135.27	77.08	77.53
Cameroon	100	99.72	114.05	108.90
Cape Verde	100	115.40	112.77	113.20
Central Africa Rep.	100	93.81	95.06	89.60
Chad	100	89.90	67.33	63.12
Comoros	100	84.129	108.58	108.46
Congo	100	100.21	103.03	96.57
Cote d'Ivoire	100	73.61	95.96	93.19
Djibouti	100	157.62	102.84	103.06
Equatorial Guinea	100	...	...	...
Ethiopia	100	165.08	102.48	135.80
Gabon	100	88.01	89.52	86.06
Gambia The	100	99.25	73.51	69.56
Ghana	100	53.21	21.12	21.89
Guinea	100	163.27	8.00	8.13
Guinea B. Bissau-Bisseauuu	100	44.28	3.44	2.27
Kenya	100	101.28	69.93	64.84
Lesotho	100	96.28	88.75	90.50
Liberia	100	182.91	235.97	263.84
Madagascar	100	92.72	52.41	46.11
Malawi	100	97.83	92.00	97.49
Mali	100	95.08	76.51	73.84
Mauritania	100	112.03	84.59	85.91
Mauritius	100	93.14	81.41	80.60
Mozambique	100	248.73	78.78	65.61
Niger	100	83.87	62.19	54.23
Nigeria	100	167.81	28.69	24.17
Rwanda	100	148.02	121.55	92.58
Sao Tome & Principe	100	...	...	...
Senegal	100	103.19	94.78	87.95
Seychelles	100	...	...	...
Sierra Leone	100	192.26	82.00	82.24
Somalia	100	24.64	0.72	0.46
Sudan	100	100.60	218.16	369.55
Swaziland	100	91.58	85.71	84.93
Tanzania	100	207.49	37.24	39.80
Togo	100	81.38	78.74	75.17
Uganda	100	17.51	11.04	8.48
Zaire	100	41.54	30.42	29.51
Zambia	100	84.81	74.75	66.10
Zimbabwe	100	92.50	62.57	52.25
Average	100	104.14	77.87	79.86

a/ Calculated according to CPI.

Source: IMF and BESD World Bank data bank.

Table A7: Per Capita Real Growth Rates
Annual Percentage

Country	1971-1991	1971-1980	1981-1991
Benin	-0.022	0.3	-0.35
Botswana	7.86	10.37	5.80
Ivory Cost	-2.05	2.27	-5.59
Cameroon	1.45	4.8	-1.3
Congo	2.55	3.7	1.59
Gabon	-0.33	2.4	-2.6
Ghana	1.48	-2.2	-0.8
Gambia	0.94	1.2	0.7
Kenya	1.27	2.69	0.12
Lesotho	3.64	6.35	1.4
Madagascar	-2.60	-1.90	-3.1
Mali	0.74	2.2	-0.4
Mauritania	-1.04	-1.0	-1.0
Mauritius	4.61	3.7	5.27
Malawi	0.59	1.9	-0.5
Niger	-2.82	-1.36	-4.0
Nigeria	-0.47	0.9	-1.6
Rwanda	-0.36	1.8	-2.1
Senegal	-0.32	-0.8	0.06
Togo	-0.30	2.0	-2.27
Zaire	-2.5	-3.1	-1.9
Zambia	-2.16	-1.3	-2.8

Real GDP series code is "NY GDP MKTP KN". Growth rate = $\Delta \ln (\text{Per Capita GDP})_t$.
Source: World Bank data (BESD)

Table A8: Average Annual Inflation Rates

Country	1971-1991	1971-1980	1981-1991	1987-1991
Benin	5.8	9.9	2.5	1.6*
Botswana	10.9	11.4	10.6	11.7
Ivory Cost	7.3	11.8	3.6	-0.6*
Cameroon	6.7	9.1	4.7	2.5*
Congo	5.4	8.8	2.5	-0.4*
Gabon	9.2	16.8	2.9	2.4*
Ghana	32.0	31.6	34.0	26.0*
Gambia	12.0	9.8	14.5	11.4*
Kenya	9.4	9.69	9.2	8.7*
Lesotho	11.7	10.6	12.6	13.7
Madagascar	13.3	9.8	16.0	15.0
Mali	6.4	9.1	4.2	1.8*
Mauritania	8.6	9.2	8.1	6.2*
Mauritius	11.3	15.2	7.9	7.7*
Malawi	11.2	8.3	13.6	16.5
Niger	5.7	9.9	2.4	-0.6*
Nigeria	14.9	13.7	15.8	25.4
Rwanda	8.1	12.4	4.7	5.2
Senegal	6.8	8.4	5.5	1.6*
Togo	6.1	7.6	4.8	2.3*
Zaire	39.0	29.8	47.7	60.0
Zambia	25.0	8.9	39.2	57.9

Inflation is defined as $\Delta \ln (\text{GDP deflator})_t$. The deflator series code is "NY GDP MKTP XN" (1987=100).
Source: World Bank data (BESD)

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